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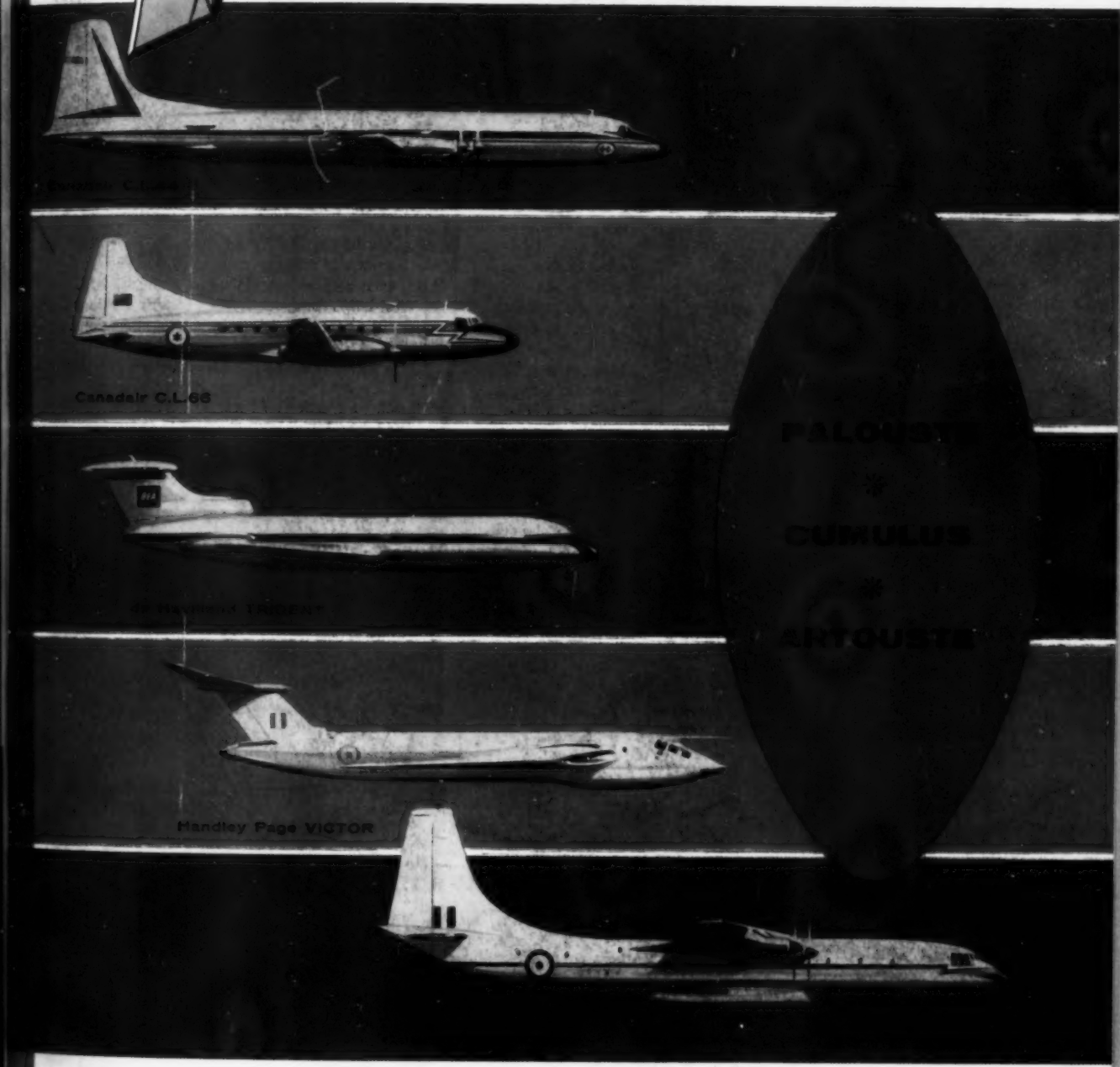

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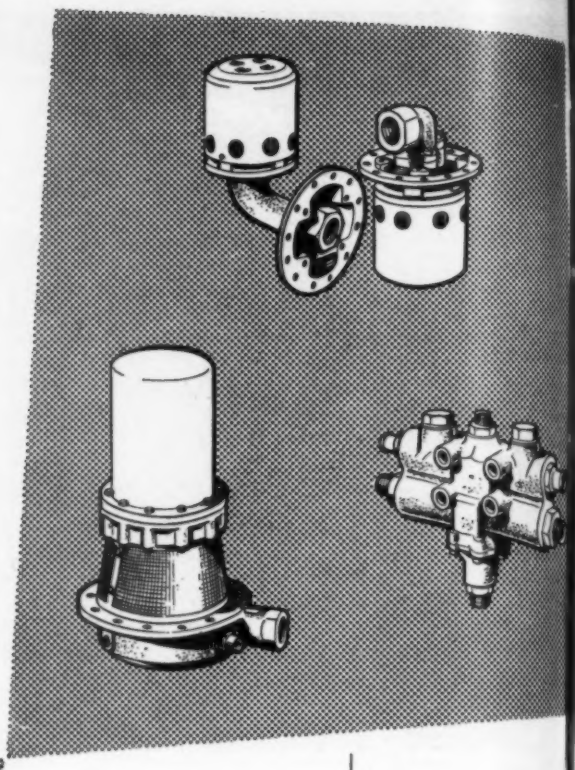

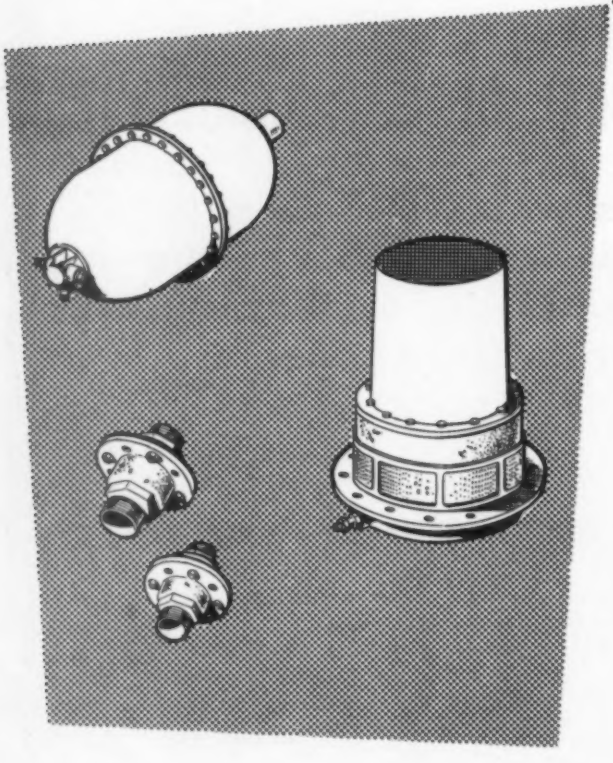

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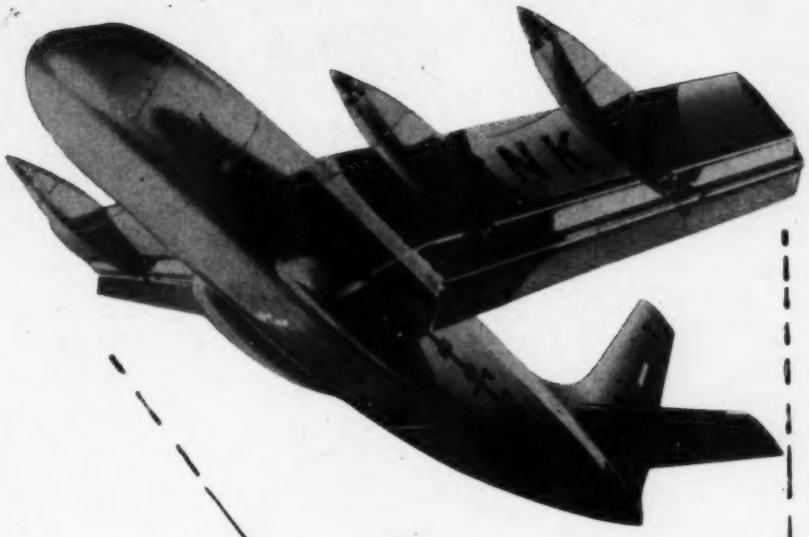

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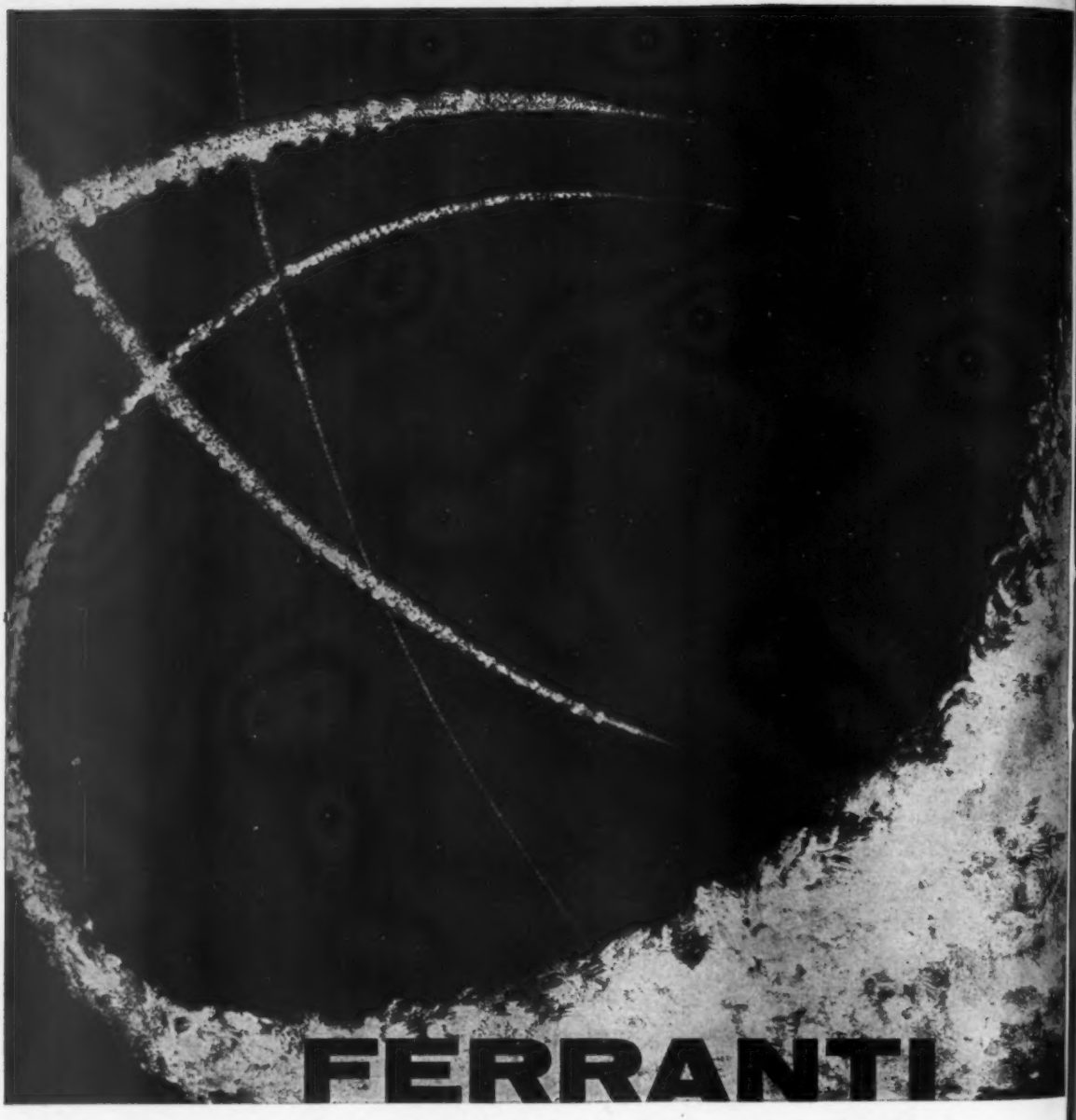

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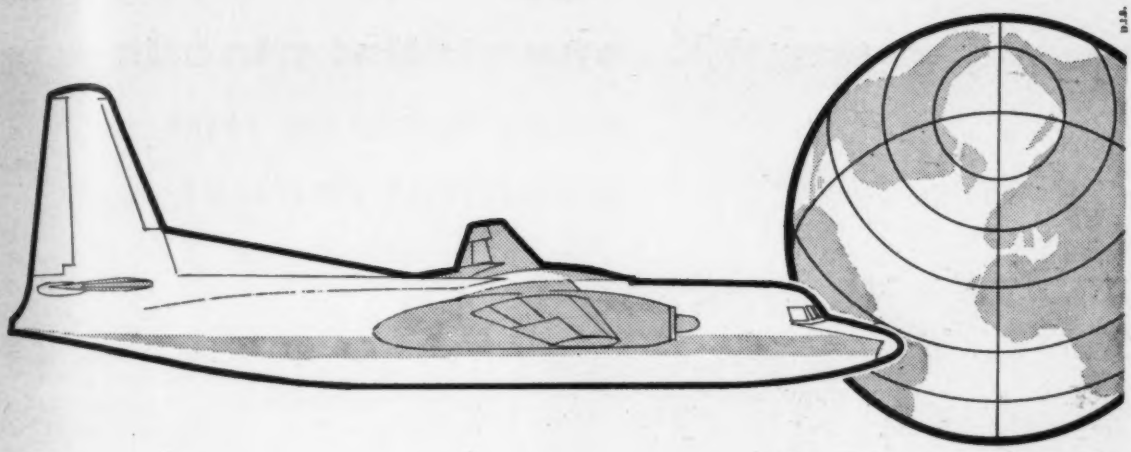


FRIENDSHIP OF NATIONS

Fokker

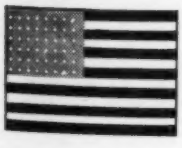
Through the centuries wise fellows like Socrates and Homer and Shaw discussed the art of being careful about friendships and money. Of course you agree.

If you buy anything, from a pin to an aircraft, you're smart to insist on something of proven value and proven quality. The people who build the Fokker F.27 Friendships have you in mind. Into the Friendship has been built economy, adaptability and money-earning capacity. The F.27 flies over deserts, pampas and water, in all climatic and geographical conditions, with complete dependability, comfort, and at the lowest possible seat mile cost.

It's unique. Today the Friendship is the only aircraft of its type in regular service in the world to have proved itself over 350,000 flying hours. Passengers like its pressurized cabin comfort and high wing visibility; airline operators in 19 countries appreciate its fatigue-safe structure, its performance and reliability.

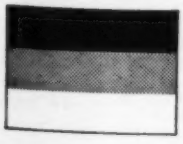
As T.H. Davies, president of the American Piedmont Airlines says: "the F.27 is the most efficient and economical short range transport aircraft available today". In five continents the Friendship of nations builds business.

IN ANY LANGUAGE



A man should make friends and money, in that order, and use both wisely. Friendships are jewels and there is more art in saving than gaining.

Insan, sirasi ile, dost ve para edinmeli ve ikisinide akillica kullanmalıdır. Dostluk bir ziynettir ve kazanmaktan çok onu devam ettirebilmek bir san'attir.



Der kluge Mann gewinnt erst Freunde und dann Geld. Freundschaften sind wie Perlen, und es ist schöner zu bewahren als zu gewinnen.

Een verstandig mens maakt eerst vrienden en dan geld, en gebruikt beide met overleg. Vriendschappen zijn als juwelen en het is een grotere kunst te sparen dan te verdienen.

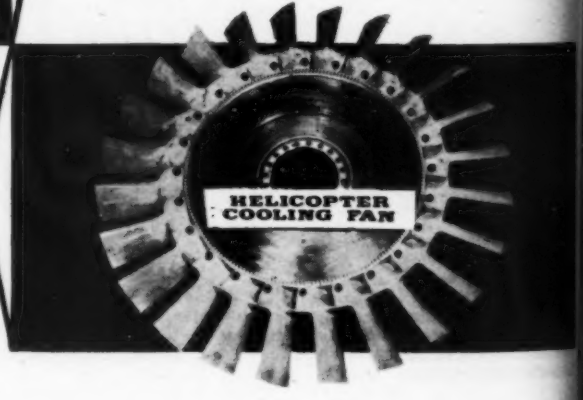
BAPL specialist plastics services to the aviation industry

SCANNER Indicative of the exceptional development facilities within the BAPL organisation, this high-speed radar scanner was manufactured to M.O.S. precise specification. The use of plastics resulted in an instrument of higher operational efficiency—with lower manufacturing costs—than an all-metal counterpart.

DUCTING Complex shapes of ducting, in plastics, for aircraft air-conditioning systems require the combined aerodynamics and plastics experience implicit in the BAPL organisation. An example of the successful use of glass fibre laminates in this field is the complex ducting system manufactured by BAPL for the Bristol Britannia.

DROP TANKS Plastics drop tanks, designed and manufactured by BAPL, have the same strength and weight as their metal equivalents, but are cheaper to make and more easily stored and handled. The Bristol plastics drop tank was the first to gain full Air Ministry design approval; they are entirely satisfactory at supersonic speeds and fully combat rated.

COOLING FAN Another example where the use of plastics materials has resulted in a component with characteristics markedly superior to a metal or alloy equivalent. This glass fibre engine cooling fan, fitted to Bristol Sycamore helicopters, is used in conjunction with a collector air duct assembly which, manufactured from glass cloth and polyester resin, is another example of BAPL research and development.



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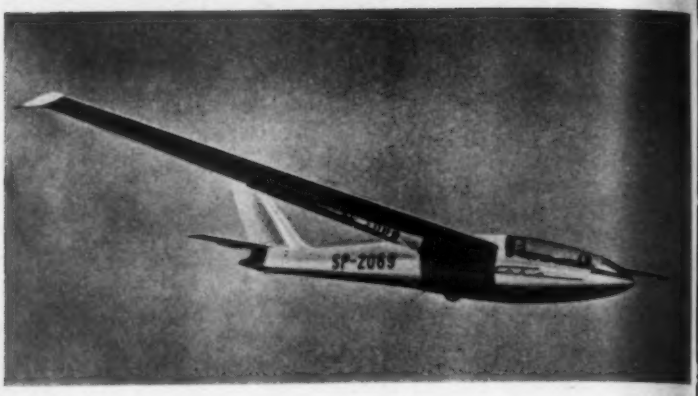

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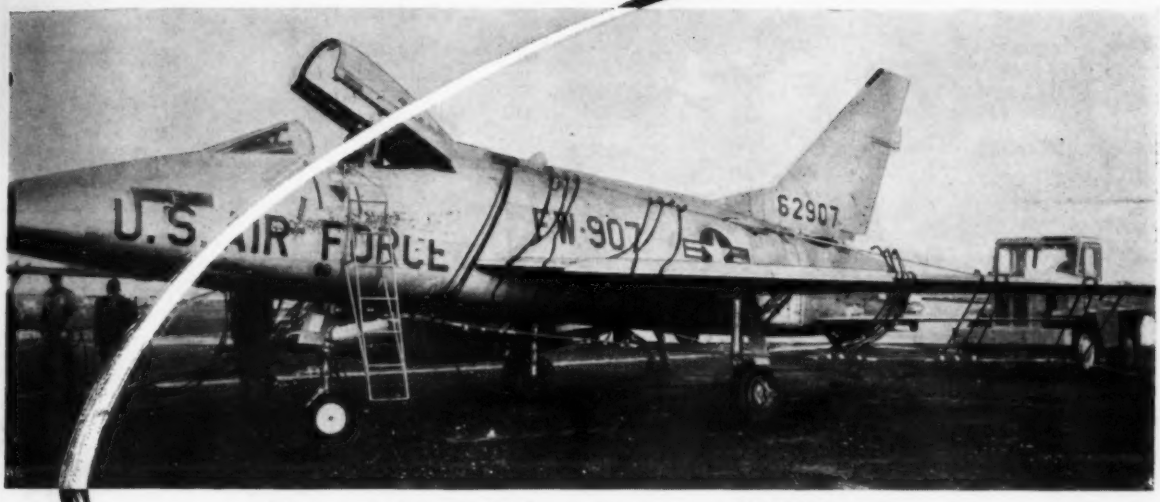

F-100 Super Sabre arrested in emergency at an USAFE airbase.

The most advanced of today

Arresting aircraft the Safeland-way—aircraft which for some reason overshoot the runway—has proved to be the most reliable and safe way. Due to the many 100 per cent successful arrestings in emergency and owing to the pilots' and technicians' great confidence in Safeland, re-orders have steadily increased in number. The extensive work by Safeland technicians has resulted in development of new barrier types suitable for almost all jet aircraft up to DC-8, 707 and similar.

RAF saved £500,000 in 9 months

According to information received, RAF has saved £500,000 in 9 months thanks to Safeland barriers. The lives of at least 3 pilots were saved in distress situations. This says a lot for the reliability and advantages of the Safeland barriers.

25 airforces rely upon Safeland

The great number of Safeland barriers delivered to the many air forces all over the world—up to now 25—prove the extreme capability of this safety device. The many re-orders also offer conclusive proof of this fact.

30 types of aircraft tested

About 30 different types of aircraft have been successfully tested and engaged in emergency by Safeland barriers. Tests have been carried out in engagement speeds 50-135 mph and aircraft saved in emergency 30-175 mph. All arrestings in emergency have been to the entire satisfaction of the authorities concerned.

Why USAFE employs Safeland

The US Air Forces in Europe have discovered the advantages of Safeland barriers in offering the highest degree of safety to the pilots and in having saved expensive aircraft in many dangerous situations. It remains the opinion that a Safeland installation is an excellent investment and will prove itself invaluable during wet and icy runway conditions as well as emergencies.

Two arresting systems in one!

The Safeland arrester net can also be delivered for hook arresting—a far advanced device. This implies essential advantages as to the possibilities of serving aircraft both with or without tail-hook using the same barrier. Another advantage is that the design of the new Safeland brake units enables the barriers to be operated in both directions. Older types of Safeland-installations can be modified at a low cost. We will give you more information about this combined system upon your request.

Safeland covers the whole field in the matter of aircraft arresting problems. Our experienced technicians are always ready at your service regarding your arresting problems. *Ask for detailed information.*

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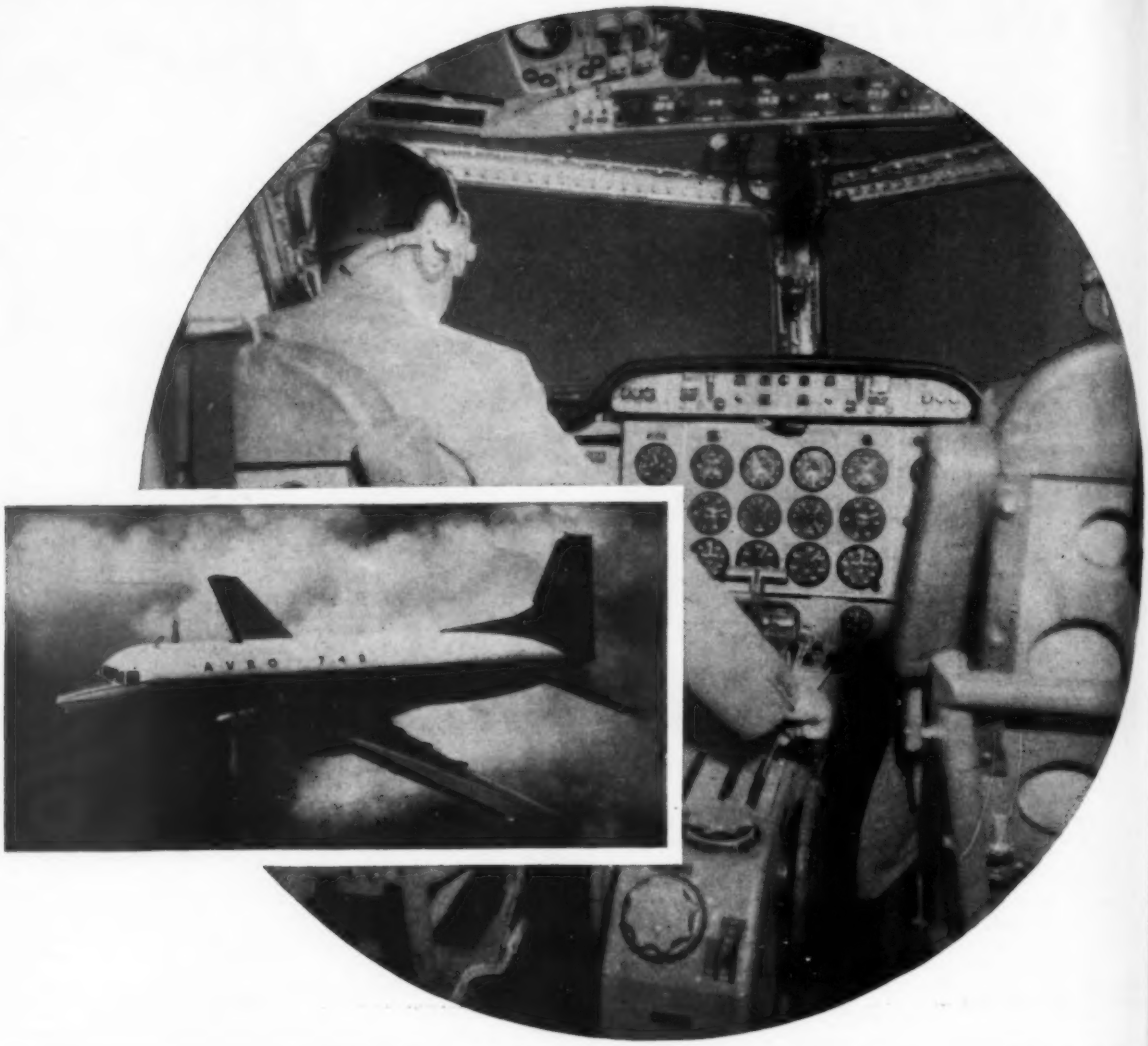

AVRO 748

flies into service soon

The Avro 748, powered by two Rolls-Royce Dart engines, has been ordered by leading airline operators in four continents.

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No 2725 VOLUME 79 THURSDAY 1 JUNE 1961

FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded in 1909

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European Mindedness

ONLY a few months ago the managing director of a British aircraft company was heard to remark that the European Common Market was "not likely to come to anything." Fewer and fewer leaders of British industry now share this hitherto commonly held view; and quite clearly the Government no longer does so. If Britain joins the Common Market the people of our aircraft industry—as of all our industries—will have to adjust themselves to thinking as Europeans.

As a Briton walks into the 24th Paris Salon Aéronautique, he will observe that UK participation is impressive. All the big firms are there. The names of Hawker Siddeley Aviation, British Aircraft Corporation, Westland, Rolls-Royce and Bristol Siddeley mingle with those of Sud-Aviation and Dassault, Breguet and Nord, Fiat, Fokker and Messerschmitt. The outward impression is that we are not just Britons showing the flag and allowing people to buy our wares, but Europeans marketing with Europeans. The deeper impression is a growing awareness among British engineers and salesmen that the European industry's future is our industry's future. American participation is forceful and impressive; so is the evidence—which we remarked on after the 1959 Salon—of an integrated Continental effort, exemplified by real international co-operation, and not just lip service to a splendid ideal.

Of course, even without the Common Market our industry has, in the familiar phrase, been getting into Europe. So indeed have the Americans, who are now trying to buy into the firms they can't beat. Some UK concerns have been slower to see the light than have others, and Frenchmen and Germans still say that the British idea of co-operation is selling rather than buying. But the long-term prosperity of our industry will be the reward of European-minded managements.

Great Expectations

THAT all who glide are "crackers," as Lord Brabazon opined on presenting the prizes at the National Gliding Championships at Lasham last week, is a debatable point. After all, there might conceivably be other reasons for the funny hats, the affection for cu-nim interiors, and the devotion to a type of flying which involves spending most of one's time slaving, or waiting, on the ground. But Brabazonian quotes aside, the gliding fraternity have good reason to be pleased with the present status and future prospects of their sport.

This year's championships showed that the British gliding movement can tackle the organization of large-scale contests better than can most other countries. Tailoring the days' tasks to the forecast weather has become an exact science, and the tasks themselves now include out-and-return races, triangular races and other demanding contests. The lessons of recent world championships have been quickly learned and applied: freak results arising from freak weather, for example, have been eliminated by the variable-maximum marking rule introduced this year at Lasham (and outlined by organizer Ann Welch in *Flight* for May 11).

At the opening of the championships came good news for the future. The way was now clear, the Minister of Aviation announced, for Lasham to continue on a secure basis as a British, and possibly a Commonwealth, gliding centre. This, coupled with the loan fund recently set up by the SBAC and Shell-Mex and BP as a successor to the Kemsley Flying Trust, gives British gliding its biggest opportunity yet. Lasham's "Great Expectations," described in detail by the chairman of Lasham Gliding Society in our issue of May 18, may soon be realized.

FROM ALL QUARTERS

News of the Week

PARIS is the dominating feature of this issue. In our first report of the 24th International Aeronautical Salon, starting on page 734, will be found—in alphabetical location—details of the record 1,110 m.p.h. transatlantic crossing by a Convair B-58 Hustler, the de Havilland Red Top, Matra R.530 and Short Seacat 2 missiles, the Armstrong Whitworth Argosy 200, Dassault Spirale III and Sud-Dassault Super Caravelle transports, the Weser-Sikorsky WF-S 64 helicopter and the SNECMA Atar 9K turbojet. And, on page 744, is news of a dramatic acceleration in America's programme of space-exploration.

German Orders

AFTER discussions in London on May 24 between Herr Strauss, the West German Defence Minister, Mr Watkinson, the UK Minister of Defence, and Mr Thorneycroft, Minister of Aviation, it was announced that direct orders for the Bristol Siddeley Orpheus engine are being increased and that substantial orders for Rolls-Royce Tynes are in prospect for the Transall transport. It was decided to conclude an early agreement for the joint development of VTOL light strike fighters on the basis of the Hawker P.1127, and also to develop jointly, in association with France, the Rolls-Royce RB.162 engine, no details of which have been released for publication. Technical and industrial teams are to meet in the near future.

Buccaneer S.2

AS this journal intimated on November 18 last, Blackburn Aircraft are engaged in the development of an advanced version of the Buccaneer, powered by a military version of the Rolls-Royce Spey turbofan. Designated Buccaneer S.2, the new aircraft will be a multi-purpose, all-weather strike aeroplane for operation from carriers of the Royal Navy. It will be capable of carrying thermo-nuclear weapons, and like the Buccaneer S.1 is stressed for maximum-performance flight at sea level—"below the reach of enemy radar," according to Blackburn.

This new application will be most valuable in increasing the scope of the Spey development programme, and the amount of Government money being put into it. As we noted in our description of the engine, on May 18, substantially increased ram pressures and temperatures (compared with the conditions which the powerplant will encounter in civil airliners) will require corresponding strengthening of the engine carcase. At the same time, it should be possible to rate the Buccaneer engine at a figure very much higher than the 9,850lb guaranteed minimum of the civil Spey Mk 1.

HSG's Seventeen Months

WELL over £15m—£15,649,000—has been written-off by the Hawker Siddeley Group on design and development of private-venture aircraft in the seventeen months ended December 31 last. This "substantial write-off," as it is described in the group's preliminary accounts (published last week), covers expenditure on the Argosy, Avro 748, Trident, DHC Caribou and DH Gnome engine.

NEW ARRIVAL: Vigors Aviation's first Piper Cherokee, seen here, arrived in this country on May 23 and was flown over to the Paris Show last Friday. It will return on June 5 and will be available for a fortnight. The price of the standard aircraft, with 160 h.p. Lycoming engine, is £5,317, fly-away Kidlington

The charges, it is stated, "demonstrate the necessity for large private-venture expenditure to keep Hawker Siddeley in the forefront of the aviation industry." The group reports a trading profit, for the seventeen months, of £29,057,866.

RAF STOL Transports

IT appears that there are now three main competitors in the competition for a design to meet the Air Ministry's draft Operational Requirement for an STOL transport, first reported in our issue of February 17. Originally there must have been at least 12 possible runners, approximately half of which were completely new designs and half modifications of existing aircraft—in particular, of the Belfast and Argosy.

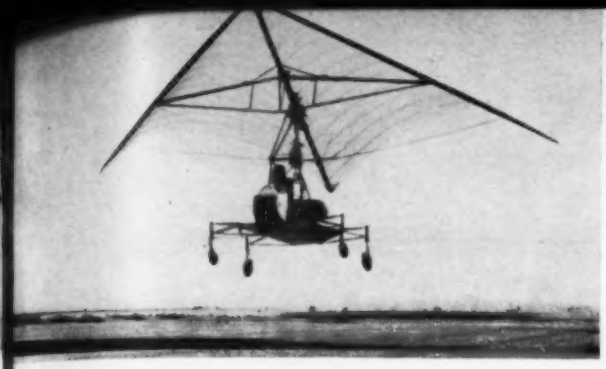
We are naturally not permitted to divulge any of the terms of the Requirement, but the published characteristics of the BAC-222 are such that it is no difficult task to form a picture of what is being asked for. As a direct Beverley replacement, the new aircraft must have a hold capable of accepting large indivisible loads and military vehicles, and rear doors for air dropping. It would be logical to expect complete pressurization, provision for flight refuelling and a sighting panel for a supply aimer in the nose. The aircraft must be compatible with existing minor airfields, have self-contained starting and conditioning systems and low-pressure tyres for operation from unprepared surfaces. So much is logical speculation; and the size of the aircraft is suggested by the fact that one of the entries is derived from the Lockheed Hercules.

Designated BAC-222, this machine in an optimized blown-flap derivative of the long-range C-130E. Powered by four Rolls-Royce Tynes similar to those now under development for the Westland Rotodyne, sufficient shaft-power would be available to drive both the propulsive propellers and the auxiliary compressors required for flap-blowing. Such a system should be light and efficient, and appreciably cheaper than the "eight-engined" C-130C. This Lockheed private-venture aircraft gave blown-flap demonstrations at the Vickers airfield at Wisley, Surrey, on May 24, and is now at the Paris Salon. Should the BAC-222 win the competition, it would be manufactured by British Aircraft Corp, final assembly probably being at Filton.

BAC's other entry is the BAC-208. Like its rival from Hawker Siddeley Aviation, originally designed by Armstrong Whitworth Aircraft, the BAC-208 is a high-subsonic transport of very advanced design. In appearance both may well resemble smaller versions of the Lockheed C-141, with one major distinction: the powerplants will be Bristol Siddeley BS.53 Pegasus lift/thrust engines. Each aircraft will have four Pegasus, mounted in underwing nacelles. Swivelling nozzles would probably be turned to the rear at the start of the take-off run, and then at some 70 or 80kt deflected to

BRITISH THERE: Mr Kruschev spent some time on the Ultra Electronics stand at the British Trade Fair in Moscow, hearing about Sarah homing equipment (trans-receiver in foreground) and engine-control systems. Russia, he said, "may well have requirements for Sarah"

RUSSIANS HERE: Soviet delegates at the Napier conference on anti-icing: (left to right) C. K. Trunov and R. Tenishev, from the USSR Civil Air Fleet Research Institute, and V. Smirnov, London manager of Aeroflot. (See "Attacking the Ice Problem," opposite page)



NYLON DELTA: This single-seat experimental aircraft with a flexible wing of plastic-coated nylon made its first flight at San Diego on May 23 in the hands of Lou Everett, Ryan test pilot. The Flex Wing was described in our March 23 issue

BEAGLE GROUP flight operations manager beginning his new duties on June 5 is Mr John Nicholson, chief test pilot of the de Havilland Engine Co since January 1957. An ex-Boscombe Down pilot and CFS examiner with over 4,000 hours on more than 50 types, he is a member of the SBAC Test Pilots' Committee

about 60° to provide a considerable lift component while maintaining thrust greater than drag.

According to the *Sunday Telegraph*, the RAF would have to wait until 1965 for either of the all-British machines, whereas the BAC-222 could be available a year earlier, and for only a fraction of the development cost. But the Pegasus-powered projects should meet the upper, instead of the lower, end of the cruising-speed requirement, and should be capable of eventual development to VTOL operation. In fact, if its development were pressed forward with all speed, one might even be acceptable to the USA and NATO.

Attacking the Ice Problem

DELEGATES from Russia (picture opposite) were among the 200 who attended Napier's ice-protection conference, held last week in the RAeS lecture hall in London. Others were from the UK, Canada, France, Germany, Holland, India, Japan, Switzerland and the US. At the morning session Messrs A. G. Smith and C. Jones of Blackburn Aircraft read a paper on the use of boundary-layer air for de-icing, and in a paper given later in the day Mr D. C. Tanner, of T.K.S. (Aircraft De-Icing) Ltd, suggested that there was a good case for using fluid de-icing in conjunction with laminar-flow air. Mr Tanner went on to discuss the difficult problem of de-icing helicopter rotor blades, and in another paper Mr R. D. Crick of Napier mentioned successful work on the electrical de-icing of such blades.

A "Flight" Opportunity

A VACANCY has arisen on the editorial staff of *Flight* for a man with air transport experience. Our specification is reasonably flexible: the one firm requirement is that the right man shall have a good working knowledge of the air transport business as well as ability to write. The scope of the job is as wide as the industry itself, embracing equipment, operations, economics and traffic; and the work is expanding as the industry itself is expanding. Here is a challenge for a young man with initiative, intelligence and a flair for expressing himself. There are opportunities for travel and for using a staff aeroplane. The salary would depend on experience and age. Prospective candidates should address their applications to The Editor, *Flight*, Dorset House, Stamford Street, London SE1, giving particulars of education, qualifications and experience, and stating salary required.

IN BRIEF

In its latest flight, from Edwards AFB on May 25, the North American X-15 attained 3,370 m.p.h.—296 m.p.h. faster than its previous best. It was flown by Joseph Walker, NASA chief test pilot.

AVM T. A. B. Parselle, SASO at Bomber Command, has been appointed Deputy Air Secretary at Air Ministry from next September. He will be succeeded at Bomber Command by Air Cdre S. W. B. Menaul, who will have the acting rank of air vice-marshal.

Three McDonnell F4H-1 Phantom IIs of the USN established an unofficial US coast-to-coast record on May 24, the fastest of the trio crossing from Ontario, Calif, to New York in 2hr 47min. The Phantoms were flight-refuelled.

MR B. A. CHALMERS, who has been appointed secretary of Bristol Aircraft Ltd. Mr T. B. Pritchard, who was financial director and secretary, is to continue in the former capacity

The Rolls-Royce "Flying Bedstead" VTOL experimental aircraft has been added to the National Aeronautical Collection at the Science Museum, where it will have a prominent place in the new extension (*Flight*, May 11).

Mr Norman Jones was fined £110, with £150 costs, at Buckinghamshire Quarter Sessions last week for breaches of regulations on a flight in a Piper Cub from Panshanger to Denham. A summons for entering the London control zone without permission was dismissed.

An official invitation has been extended to NATO representatives by Microcell Ltd, a member company of BTR Industries Ltd, to make a study of the glass-fibre launchers developed for 2in rocket armament. These launchers can be adapted for use on various aircraft, including the TSR.2 and Blackburn Buccaneer, if they were to carry an alternative type of armament.

The first council of the British Aircraft Users Association (*Flight*, March 23) consists of the following members: Mr M. A. H. Bellhouse, Pressed Steel Co Ltd (chairman); Mr Hector Laing, McVitie & Price Ltd; Mr Kenneth McAlpine, Sir Robert McAlpine & Sons Ltd; Mr T. S. Kilpatrick, United Steel Companies Ltd; Mr Geoffrey Woods, Woods of Colchester Ltd; Mr E. W. Pasold, Pasolds Ltd; Mr L. H. Riddell, Yorkshire Patent Steam Wagon Co Ltd; Mr J. Riseley Prichard, Willis, Faber & Dumas Ltd; Mr R. A. Smight, Oxford Aviation Ltd; Mr T. A. Vigors, Vigors Aviation Ltd; Mr Peter G. Masefield, Royal Aero Club; Col R. L. Preston, Royal Aero Club. Chief executive of the Association will be Sqn Ldr R. R. Stephenson. The Association has a total of 40 founder member-companies.

The first USAF F-105D Thunderchiefs to become operational in Europe arrived last week at Bitburg, Germany, having flown nonstop from Mobile, Ala (see "USAF types", p. 741).

The West German Air Force now has its first all-weather night-fighter squadron. It was formed recently at Neuburg, Bavaria, with thirty-six F-86Ks. These are later to be replaced by Starfighters.

Bell Helicopter Co are experimenting with a rigid-rotor helicopter, having no hinges at the blade roots. Advantages are said to be simplicity of construction and maintenance, faster response to pilot control and much greater range of c.g. travel. Flights have been made at more than 100 m.p.h.; and while the aircraft was hovering a man has pulled on the tail-boom without serious effects.

Lockheed Aircraft have a contract to design and produce five full-scale aerodynamic models of a titanium capsule intended for escape from aircraft flying at 2,000 to 2,500 m.p.h. at heights up to 25 miles. A rocket would separate capsule from airframe, and high-drag stabilizers would slow it down before the main parachute opened. The capsule is intended for aircraft flying in 1965-68.

Camera enthusiasts should make a point of seeing the current (May 31) issue of *Amateur Photographer*, a special number dealing with the 1961 International Photo-Cine Fair now in progress at Olympia.

APPOINTED Hawker Siddeley Aviation representative in Germany is Maj C. H. Vallance, sales manager of Blackburn Aircraft since he retired from the Army in September 1957. His appointment follows the news of the trading association between HSA and the Otto Wolff Group, at whose Cologne HQ he will be based. Succeeding Maj Vallance as sales manager at Blackburn is Mr M. G. K. (Mike) Byrne, AFRAeS (centre), hitherto public relations and publicity manager; and now appointed to the latter post is Mr D. W. Bainbridge (right)

ILLUSTRATED BY FLIGHT *PHOTOGRAPHS*

SALON EXTRAORDINAIRE

A FIRST APPRAISAL OF THE TWENTY-FOURTH PARIS SHOW

Le Bourget, May 29

AFTER five days at this show the visitor's first impressions fall into perspective. The Americans tend to dominate the party, because as well as making good aviation products they are also born showmen: and Strategic Air Command pulled off a great prestige ploy when they flew a B-58 across the Atlantic in less than 3¼hr. One stands closest to the altar of international prestige here when contemplating this same Hustler parked wing to wing with the Tu-114. " I'm bigger than you," says the Tu-114. "But I'm faster than you," snorts the B-58. "I'm peaceful and you're nasty and warlike," retorts the Tu-114. In a real conversation a Frenchman is heard to quip that Russia built the Tu-114 primarily for exhibiting at the Salon.

Yes, there is exhibitionism in this exhibition, but inside the prestige wrapper is a trade show that means business. This is a show where selling, particularly of light aeroplanes, is direct. All day long, customers climb into aeroplanes and fly them; except for the two flying-display days, the sky over Le Bourget is in constant use by demonstrators, with commercial airliners coming and going as on any normal day in the airport's life. Inevitably one imagines the expression on staid Auntie London Heathrow's face at the bare thought of such goings-on.

Naturally, the French accent is strong. Entering the big bay-fronted main exhibition hall of the Union Syndicale des Industries Aéronautique one sees, in line abreast, the stands of the big French companies—Sud-Aviation, Breguet, Nord, Dassault, Max Holste and Hurel-Dubois. The eye is arrested at once by the model of Sud's supersonic airliner—a completely surprising exhibit, and *not* dreamed up by the publicity boys. It is, says a Sud engineer, "exactly representative of the project at its present stage of development." Then the eye scans the overhead nameboards, and registers the great strength of British participation.

There is a third hall this year, Hall C having been added to provide almost half as much floorspace again. Three hundred firms of a dozen nationalities are stall-holders in this aeronautical market place—and the whole thing takes much, much longer to absorb than the last Salon did in 1959.

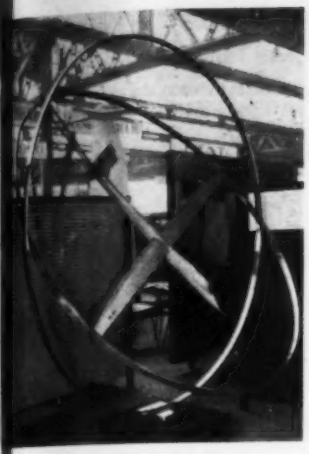
There are surprises other than the Sud supersonic airliner. There is the Max Holste Broussard Major—only a full size *maquette*, but the real thing is being built. It looks more like a Super Broussard Minor than a Broussard Major, and it is taken seriously by those who have noted the way that the customers (four of them Australian) are jockeying for a place in the queue for the Super Broussard.

There are signs of increasing British European-mindedness. Exemplifying this is Red Top; Engins Matra are now working with DH on this Firestreak development. The combination of DH infra-red and Matra radar should also lead to a new air-to-air missile for NATO, based upon Matra's R.530.

Two more complete surprises—the Dassault Spirale III twin-Astazou light transport project, and Pratt and Whitney's prodigious JT11. And attracting a constant press of people is Cdr Alan Shepard's NASA Mercury capsule. This is in the US Space for Peace exhibition under a sort of Dome of Discovery near the missile park. You can touch it—and not be able to resist touching it. Peering inside at the dummy one marvels at the courage of the real man. Nearby can be seen a film—so much more telling than still photographs—of what happens to men when they are weightless: they dive and twist about like bass seen through a glass-walled aquarium.

This space exhibition is really impressive. Nowhere to be seen are any nasty warlike American missiles—obviously a high-level Pentagon policy decision. But in the aircraft park there are plenty of warlike American aeroplanes—five of them Mach 2, like the USN's A3J-1 Vigilante, F4H Phantom II, F8U-2 Crusader, and the USAF's F-104 and F-105. In contrast to the restrained paint-jobs of the RAF's Victor 2 and Vulcan 2 (whose very roundels, in their pale anti-flash tones, are self-effacing), the US machines are blazoned with stripes, diamonds, lightning flashes and badges. Their crews stand beside them, all looking like the real tough all-American boys they are, in orange and green flying overalls disporting flamboyant badges and the name of the wearer.

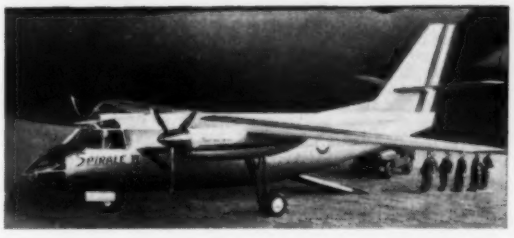
It is a great show—perhaps, old Barnum might agree, the greatest show on earth. There is a circus atmosphere, but anyone who thinks that no sales battles are won or lost here is mistaken.



Above, the B-58A Hustler, shortly after its 1,110 m.p.h. transatlantic crossing

Left, the German DFS.582 sailplane for exploring the upper atmosphere

Right, model of the completely new Dassault Spirale III, powered by Turmo 3C engines



Aircraft

Aeromere F.14 Falco Two of these sporting 140 h.p. two-seaters have been demonstrated.

Agusta Bell 47 Both the G3 and J3 Super Ranger versions are flying at Paris. More than 700 of all the G and J versions have been made by Agusta to date. The J3 on show is an Italian military machine.

Agusta 101 A model shows the configuration of this machine to be virtually unchanged. A prototype is due to fly towards the end of this year, but choice of powerplant still lies between three Gnomes or three Turmos—the former being more likely. Design and production have progressed slowly over the last two years as a private venture.

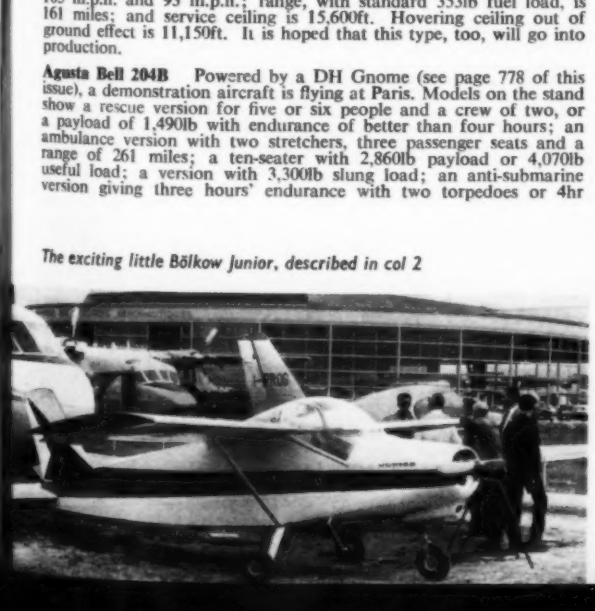
Agusta Bell 102 Shown in model form, this nine-passenger, piston-engined helicopter with a 2,010lb useful load is a promising commercial venture and is in production. It has a good payload and is cheap at LIt90m (1,740=£1). Two or three have been sold in Switzerland and up to four are being delivered to the Italian civil aviation authorities for subsequent sale to Elivie, the Milan helicopter airline.

Agusta 104 One of a range of ultra-light helicopters proposed by this company in recent years, the 104 is a two-seater powered by an Agusta four-cylinder-opposed 140 h.p. engine. The engine is already certificated, and similar qualifications are being sought for the airframe. Production for the civil market will begin at the end of the year. The side-by-side, two-seat cabin with dual controls is enclosed and the rotor is of teetering, two-blade Bell type with stabilizer bar. Useful load is 573lb and gross weight 1,411lb. Maximum and cruising speeds are 103 m.p.h. and 83 m.p.h. and hovering ceiling in ground effect is 9,840ft. Best range and endurance are 205 miles and 2hr 30min.

Agusta 115 Expected at the show during the week, this type is powered by an Astazou II turboshaft engine derated to 320 h.p. and has been developed by Agusta. Using a Bell 47G rotor and tail boom, it has 47J transmission and undercarriage and a new four-seat cabin similar to that of a 47J. Useful load is 1,360lb and rated power can be restored to allow full-weight landing and take-off at heights up to 13,800ft. The basic four-seat cabin can be laid out for freight, ASW gear or for one stretcher. Two additional stretchers or freight can be accommodated on the skid struts and suspended loads may be carried. Maximum and cruising speeds are respectively 105 m.p.h. and 93 m.p.h.; range, with standard 353lb fuel load, is 161 miles; and service ceiling is 15,600ft. Hovering ceiling out of ground effect is 11,150ft. It is hoped that this type, too, will go into production.

Agusta Bell 204B Powered by a DH Gnome (see page 778 of this issue), a demonstration aircraft is flying at Paris. Models on the stand show a rescue version for five or six people and a crew of two, or a payload of 1,490lb with endurance of better than four hours; an ambulance version with two stretchers, three passenger seats and a range of 261 miles; a ten-seater with 2,860lb payload or 4,070lb useful load; a version with 3,300lb slung load; an anti-submarine version giving three hours' endurance with two torpedoes or 4hr without. Eleven are being made for the Swedish Army and Air Force and military options have been taken by several countries. Delivery of production machines is offered in October. Price is about LIt140m (1,740=£1).

The exciting little Bölkow Junior, described in col 2



Armstrong Whitworth Argosy C.1 (XN817) Exhibited by its manufacturers in the static park, this is the fourth of the Transport Command Argosies. RAF cargo rollers, stretcher and seating installations are shown, and there is a daily demonstration of the tricky job of driving in an Alvis Saracen armoured troop-transporter through the "crocodile" rear loading door. Marconi Doppler is in the starboard tail boom and Ekco weather radar in the nose, above the supply-aimer's window and crew-entry hatch.

Armstrong Whitworth AW.650 Argosy On May 28 Hawker Siddeley Aviation announced the Argosy 200—existing AW.650s will henceforth be designated Argosy 100—incorporating major and minor improvements. Biggest change is the adoption of a "fail-safe" box-spar wing, which will be some 1,000lb lighter and confer other benefits. A new batch of civil machines is being laid down, and all will be 200s unless a customer specifies otherwise. Aloha and BEA are discussing 1963 delivery of this new version. AWA are demonstrating a lighter and cheaper Rolamat cargo-handling system.

Avro Vulcan B.2 (XJ782) No 83 Sqn has contributed this example, which bears the new pale anti-flash markings.

Avro 748 Expected to arrive today, June 1, one of the two aircraft now flying (probably the second, G-ARAY) is due to appear in time for the commercial transport display and public days.

Beagle-Auster Airedale (G-ARKE) This first Beagle arrived on Saturday and has been demonstrated in flight. It is certainly the first British light aircraft which can take part in the Paris show demonstrations on equal terms with comparable European and American types.

Beech types Standard models of the Twin Bonanza, Baron, Bonanza and Debonair are on show. The remarkable SFERMA Marquis version of the Baron is described on page 740.

Bell H-13 Sioux The US Army brought a spectacular air-drill team of five from Fort Rucker, Ala, to show expert square-dancing and a yo-yo act. Also representing the US Army were several H-3As.

Boeing-Vertol 107 N74060, the prototype that has recently been with New York Airways for route-proving tests, is at the show giving demonstrations. Three other pre-production aircraft have flown, and the first production machine (one of five on order for NYA) flew on the eve of the show. To date 42 firm orders have been placed, and production of 50 is in hand. NYA, the only commercial customer, expects to start services in August, following certification and delivery in July. Ten 107s are for the Japanese Navy and Army, and seven of them are being built by Kawasaki. The US Marine Corps has ordered 15, and may have a requirement for several hundred. The Canadian services have ordered six, and may require 50 eventually. The Swedish Navy and Air Force are to have six.

Bolkow Junior (SE-CPF) The most exciting light aircraft at Paris—if not in Europe—the Junior was originally the Andreasson BA-7, designed in America when Mr. Andreasson was employed by Convair. It was then brought to Sweden, where Malmö Flygindustrie are preparing it to make it as the MFI-1. Now Bölkow have the licence, and plan to certificate it to CAR-3 and make a batch of 260 in 18 months from September.

The Junior is a side-by-side two-seater powered by a Continental 100 h.p. engine and having a gross weight of 1,196lb. It will cruise at 149 m.p.h., can be spun, is aerobatic and has an endurance of 4hr. The cabin is as wide as that of a Cessna 150, but the shoulder wing with cut-away roof gives full visibility. The wing itself is based on an I-section extruded spar with seven ribs and thick, flush-riveted skin taking torsion loads. It is swept forward 3° and has a NASA 2300 aerofoil, 8½ per cent thick, with a drooped leading edge giving excellent stalling characteristics. Narrow-chord ailerons are outboard of long-span flaps which are operated by worm-drive from a control

SALON EXTRAORDINAIRE...

between the pilots' heads. The flaps are actuated only at their inboard ends and torsional stiffness is maintained by Styrofoam rigid foam. The undercarriage, with a steerable nosewheel, has spring-rod main legs, each fastened to the fuselage with one bolt, and a graded rubber-in-compression nose strut. Hydraulic brakes are fitted. The tailplane is an end-plated slab with anti-balance and trim tab.

Four longerons, and skin panels, form the main members of the aft fuselage, there being only a few light frames. A single, built-up frame takes wing, strut, undercarriage, seat and harness stresses. All major parts are stressed for 6g.

The first MF-1 Junior has flown 60hr in Sweden; and SE-CPF, the second machine, has flown ten hours. There is room for a small radio and a full blind-flying panel. Range is 560 miles. Reports indicate that handling characteristics are really good and that the aircraft is docile and very quiet. The cockpit is perhaps a little tight, but the short control column mounted between the seats makes the most of space and is comfortable to operate. There is no perceptible control friction. The price of a Junior in Germany is estimated as just over £2,000.

Bolkow high-speed rotor and gyroplane test-bed Rotating on the Bölkow stand is a four-blade rotor with long, broad-root cuffs, and blades which perform leading and lagging displacements as the assembly rotates. In high-speed flight the advancing blade lags, the the retreating blade advances, relative to the chord-line (radiuc) of the root in a centrifugal pendulum period. Lead/lag angles of up to ±40° can be obtained without creating excessive gear forces. Advantages are the reduction of critical speeds in advancing and retreating blades, considerable increase in forward speed capability without fixed-wing assistance, reduced power requirements during high-speed flight and improved glide-angle during autorotation. Translational speeds of up to 310 m.p.h. have been achieved in a wind tunnel and a gyroplane test-bed is now being developed by Bölkow.

Bolkow 102 Heli-trainer A quiet, effective little training device, the 102 is set up in the helicopter arena and is frequently in use.

Breguet 941 It had been hoped to fly the first prototype in time for the Salon, but this has not been possible. Original scheduled date for the first flight was September 1961, so Breguet are well ahead. First flight may be announced during the show. The mock-up bears witness to the military a/t-loading and dropping capability of this STOL transport—40 canvas seats for parachute troops, 24 stretchers and a jeep. The 940 test vehicle, not at the Salon, has flown about 300hr. No military order has yet been placed; some Army opinions favour the smaller 945 project mentioned below.

Breguet 942 The insignia of the French independent Air Inter appears on the mock-up of this pressurized commercial version of the military 941, and an Air Inter stewardess is on duty. The big upwards-hinging freight door at the back is noteworthy, and the interior is spacious and comfortable, with 45 seats five-abreast, and 565 cu ft available forward for cargo. The seat-backs fold for all-freighting, or seats can be taken out. No metal has yet been cut.

Breguet 945 A model illustrates the configuration of this twin-Turmo, four-propeller version of the blown-wing STOL type, together with its rear-loading facilities. The 945 design was leading in the competition for the French order for the light tactical transport, but its position is now seriously threatened by the much simpler Spirale III. Nevertheless, the problem of the complexity of the 945's propulsion and control systems should be greatly eased by the experience which will first be acquired with the big 941 transport. The 941 is still a design project.

Breguet 1150 Atlantic Little can be added to the relatively sparse details so far released from strict NATO security about this important international project; but numerous models, and a few components such as the undercarriage, indicate the extent of the manufacturing operation and the number of companies participating.

British Aircraft Corporation BAC One-Eleven Models in British United Airways livery are on display on the BAC stand, one sectioned to show the interior layout (mixed-class) of passenger and crew cabins. Fuller information about design, performance and economics is being made available.

BAC VC10 It was expected that British United would announce an order for four VC10s as the show opened, but at the time of writing no statement has been made. Models in BOAC and Ghana Airways livery are displayed.

Bristol Britannia C.1 (XL 660) Bearing the name *Alphard*, this machine is from No 99 Sqn and its cabin is fitted with sample freight, passenger and casualty evacuation furnishings, including special ball-roller freight mats, rearward-facing seating, and stretcher and oxygen equipment. There is Marconi Doppler radar in a blister beneath the centre fuselage.

Cessna types Represented in France by Fenwick Aviation, a selection of standard Cessna models is in the static park, and several were demonstrated in flight during the light-aviation day.

Convair B-58 Hustler Never before seen in Europe, the Hustler's debut was auspicious, for B-58A-10-CF number 59-2451 appeared in the Le Bourget circuit just 3hr 19min 41sec after passing over New York. This time has been submitted to the FAI for homologation as a point-to-point record, beating the previous (Boeing 707) record by 2hr 26min.

The aircraft comes from the US Air Force Strategic Air Command 43rd Bomb Wing, stationed at Carswell AFB, just across the airfield from Convair's Fort Worth plant where the B-58 is built. The crew were Maj William Payne, aircraft commander; Capt William Polhemus, navigator; and Capt Raymond R. Wagener, defensive systems operator. They left Carswell at 0310 Central Standard Time on May 26. Flying subsonically, to prevent too much ground disturbance, Washington DC was overflown at about dawn (the local time was passing at several times the true rate); New York went by 19min 48sec later, and then, once out over the Atlantic—and following the same 3,672 mile route which Charles Lindbergh flew in 33½hr in 1927—the four GE J79 engines were opened up and speed allowed to climb to about 1,300 m.p.h. A short distance east of Newfoundland, speed was brought back to M0.85 at lower altitude for a "full tanks" refuelling by a KC-135; and at 21°W longitude another KC-135 added just enough fuel for the Hustler to be sure of reaching Paris.

At 16.20 local time the needle-nosed bomber swept smokily down on to the Le Bourget runway, and then steamed thunderously round to fill the whole apron with heat haze and kerosine fumes. Walking around it one noted that it was carrying pod B-186 beneath its slender belly, and the overwhelming impression created by the aircraft was that it was remarkably small for its "mission capability." Already at Paris was Col Johnson, commander of the 43rd, who told us that the aircraft was in every respect capable of being refuelled at once and of taking off on the return trip. His wing is at present 75 per cent equipped, and will very soon receive its remaining aircraft. Three TB-58s are used for conversion.

(Certain other US military aircraft at the show are reviewed under "US" headings on page 741.)

Curtiss-Wright VTOL After accumulating over 260hr at Caldwell-Wright field on the T53-powered X-100, Curtiss-Wright are constructing two Model 200s, each powered by four T64 engines driving tilting propellers with full provision for failure of any engine.

Dassault Etendard IV P A pre-production IV P with refuelling probe and nose and ventral camera positions is in the static park. It is painted white underneath and dark grey on its upper surfaces.

Dassault Mirage III E The second batch of 100 Mirages ordered will be of this version, differing from the III C mainly in having "special store" (i.e., nuclear) capability, which has required slight lengthening of the undercarriage. The forward fuselage is extended 12in to accommodate more sophisticated electronics. Powerplant is the newer Atar 9C providing higher thrust, by overspeeding, and a better s.f.c. A camera nose interchangeable with the Cyrano radome could be provided for the III E, but has not so far been ordered.

Dassault Mirage III R This is the reconnaissance version, with an ogival nose terminating in a flat, sloping, forward-facing camera window. Oblique cameras are behind lateral windows. A camera nose is displayed in the exhibition hall. Mirage III Rs have been ordered for the French Air Force.

Dassault Mirage III C The eighteenth production aircraft is in the static park, surrounded by a wide range of stores including tandem pairs of bombs on a fuselage beam, Sidewinders, Matra 530, Nord AS.30, Matra rocket packs, JL-series combined rocket packs and tanks and plain tanks of up to 286gal capacity. A Cyrano fire-control, with its radar scope and gun-sight, are shown publicly for the first time on the CSF stand. Cyranos are not yet installed in production Mirages. The first Mirage squadron is being formed this year.

Dassault Mirage IV A Although the prototype is due to appear in the flying display this coming weekend, the type is represented only by models in the static exhibition. From one of these on the Dassault stand it appears that the radome of the operational aircraft is almost circular, and nearly flush with the fuselage contour. The wing-tips are partly rounded and a fairing at the base of the fin could contain rearward-looking electronic equipment. There is a refuelling probe in the extreme nose. Considerable rearward inclination of the main undercarriage legs is another innovation. Security has been considerably tightened since trials of the operational equipment began.

Below, model of the projected Hurel-Dubois HD-130 and mock-up of the Max Holste Type 350 Broussard Major

Dassault-Sud-Aviation Spirale III Unveiled at the Salon is a joint venture between Dassault and Sud contending for the French Army competition for a new light military transport with short-field performance. It is derived from the 6/8-seat Dassault Communauté, liaison and pilot-training aircraft which Dassault planned to develop as the Super Communauté with two Bastan V of 1,300 h.p. until this engine was cancelled. The Diplomate was a civil executive version, 20 per cent larger, but Dassault could not get French Government support for tooling, despite considerable US interest. The executive market was left to SIPA and others. The Government asked Dassault to submit a revised design of the Super Communauté by June 1961, and this is the Spirale III. A full-scale mock-up dominates the Dassault stand and some details have been released. The Turmo III of 1,295 h.p. gives the right power (the Bastan IV being too small). The Spirale III is as far as possible a direct scaling-up of the Communauté: main differences are that the wing is high-mounted and the tailplane is further up the fin. Rudder is fully powered, tailplane has variable incidence, and the wing has spoilers and airbrakes. The Spirale prototype, built two years ago, is at the show; it has flown 350hr and has been completely flight tested at the Centre d'Essais en Vol to predict the probable performance of the III.

Dassault will, if a prototype is ordered, assemble and flight test, and Sud will manufacture the complete airframe. Dassault are responsible for design.

With a take-off weight of 21,000lb a payload of 3,300lb can be transported 930 miles. Alternatively, at a take-off weight of 22,000lb, 7,700lb of freight can be flown 560 miles. The aircraft has rear loading and accommodation (facing side seats) for 21. Rough 320yd airfields of over 3,000ft altitude can be used; at 20,250lb weight take-off is 550yd. Cruising speed is about 280 m.p.h. Cabin is 23ft long, 6ft 3in wide and 6ft 1in high.

de Havilland Heron 2 (G-APEV) This executive-version D.H. demonstrator is at the Salon, as is Dove 8 G-ARDH, a smart red and white demonstrator.

de Havilland Canada DHC-4 Caribou (CF-LAN) The company's red-and-white demonstrator has come to the Salon and is displaying its short-field capabilities.

Dornier Do27 Several Do27s have been brought to Paris to illustrate various types of special equipment which can be fitted. Herr Schaefer, long famous as a spectacular exponent of the Do27, is here once again and has excelled even his own performances of two years ago, including one-wheel take-offs into a steep turn, dead-stick landings and tail-waving slow approaches. An intriguing rival is the Do27 F-WJRD, fitted by SFERMA with an Astazou and now being evaluated by Turboméca. Rates of climb of well over 1,000ft/min are being achieved at over 20,000ft.

Douglas-Piaggio D-808 First flight of the prototype of this new executive jet, on which Piaggio has begun work, is due in June 1962. The Italian company will test and develop the aircraft and will build up to a certain number, depending on how the market develops, before Douglas build also and it is decided which partner shall concentrate on which market. Certification will be by the "second part of 1962." Price has not yet been decided.

Fiat G.91R Although represented only by models, some 120 G.91R/1 fighters with four 0.5in guns, camera nose and Tacan have been completed for the Italian Air Force. In addition, fifty G.91/R3s have been completed by Fiat for Germany, and the first of 150 made under licence by Dornier and Messerschmitt will fly next month.

The G.91R/3 differs from the R/1 in having two 30mm cannon, not mounted in a gun-pack, and Bendix Doppler with Computing Devices of Canada Position and Homing Indicator 3B for navigation. The last-named system makes the G.91 virtually independent of ground-based navaids. Fiat completed a series of 40 flights of varying duration over sea and mountains, and the average position-indicating error was one per cent—often there was no error at all. The Doppler continues to function at bank angles up to 80° and the PHI memory will operate for 20sec after loss of Doppler signal before reverting to plain DR.

Another series of trials involved use of JATO. Two 1,000lb-thrust bottles shortened the take-off distance to 50ft by 30 per cent and 4 × 1,000lb reduced it by almost 50 per cent. Both take-off and landing can now be achieved, it is claimed, in about 300ft.

Latest version of the G.91 is the R/4, which has 0.5in machine guns but otherwise differs little from other models. It is intended for Greece and Turkey; and the USA has ordered 25 for each of these countries. American interest has led during recent months to the delivery of two G.91s to the US Army and two to the USAF for individual evaluation.

Fiat G.91T (NC 1 and NC 2) The first two of these tandem trainers are at Paris, the second still in its protective finish, but the first painted silver. Flight testing continues and diving speeds of M0.96 have so far been attained. A camera nose and fixed armament of two 0.5in guns are fitted. No Italian production order has yet been placed, but the first two G.91T3 trainers for Germany are nearing completion—one should fly in June—and 44 have been ordered.

Fiat G.95 A model exhibited on the Fiat stand and already illustrated in *Flight* (May 18) apparently represents a recent stage in the development of a supersonic VTOL strike aircraft having two propulsion engines in the flanks of the fuselage and two pairs of lift engines fore and aft of a fuel-tank bay. The efflux of the propulsion engines can also be deflected downwards by nozzles about half-way along the lengthy jetpipes. Fiat say that many problems remain to be solved, and that the types of engine are not yet decided. The company holds certain patents for VTOL powerplant layouts.

Fokker F.27 Friendship The first of six Friendships for All Nippon Airways is due to fly this week and to be at the Salon for the final days of the show. The Friendship order-book up to May 24, 1961, accounted for 181 aircraft (Fokker 95, Fairchild 86). Official approval by the Netherlands RLD of weight increases are announced: the RDa.6-powered version is cleared for a maximum take-off weight of 39,000lb; the RDa.7-powered version is approved at 42,000lb.

Nose of the new Morane-Saulnier Paris III

Fokker jet-transport project The company is not yet publishing details of this design-study, which is believed to be in the jet DC-3 replacement category.

General Electric VTOL Illustrated in an accompanying photograph (p. 741), GE have a model on their stand of a V/STOL attack aircraft powered by J85s driving two lift fans mounted in the wings. The company believe such lift fans to be applicable to M2 aircraft, and have conducted extensive studies into such applications (none of which have fans in the thin wings). The original 76in fan has completed much very satisfactory rig-running at Evendale.

Gloster Javelin FAW.9 (XH845) From No 23 Sqn at Coltishall, this FAW.9 is a standard Javelin with afterburners and carrying four Firestreak missiles.

Grumman Gulfstream N358AA, Atlantic Aviation's demonstrator, appears in a stylish green-and-white livery.

Gyrodyne XRON-1 Two of these little Porsche-powered helicopters are being shown jointly by Gyrodyne and Porsche. One is a piloted XRON and the other is a piloted version of the drone DSN-1 being evaluated by the US Navy; the second has no transmission clutch. The engine is a 75 h.p. Porsche, mounted upright, modified with bottom oil-sump, centrifugal fan, glass-plastics cooling shroud, and new aspiration system. Torque is avoided by contra-rotating, two-blade teetering rotors and directional control is by the ingenious method of controlling tiny tilting end-plates at the blade-tips from the rudder pedals; if the end-plates on one rotor are tilted outwards, the drag of that rotor is increased and the torque balance disturbed, causing a turn. This is very powerful, yet the rudder may be moved from stop to stop without changing engine power; and Jim Ryan, the chief test pilot, takes off with his feet off the pedals, "walks" the XRON around with his feet, and makes the complete flight without using rudder. The XRON is so docile that a pilot can begin to hover after ten minutes' familiarization, do all powered manœuvres after 40min and autorotions after 6hr. The engine is FAA-certificated for helicopters, but not the airframe. Later, the company intends to train a complete novice to fly the XRON. Cruising speed is 30-60kt, maximum speed 68kt.

The DSN-2 has another Porsche simply added in front and the tail and nose attached on the flanks so that the machine flies sideways. The DSN-3 is a projected anti-submarine drone, still secret. Civil interest has been considerable—for instance, the tuna-fishing industry have paid deposits for 20 XRONs for use as spotters with their fleets. Other helicopters are too expensive and large. Ranchers could also use the XRON. Cost of an XRON, if 500 were made, would be $15,000 to $20,000 (a Brantly costs $22,000). Civil certification is about to begin. This is a fascinating machine, but the expense of the contra-rotating rotor head must match a real requirement for hovering and true VTOL capability.

Handley Page Herald G-AODF will be at the Salon on the final Saturday and Sunday. This will be the first public demonstration of the lengthened Series 200 aircraft, which is now being sold with orders behind it for four operators.

Handley Page Victor B.1 (XA928) Wearing the new pale-blue lettering and pale roundels, this aircraft is from No 10 Sqn at Cottesmore.

Hiller 12E-4 The demonstrator shown at Paris is shortly to come to Britain.

Hurel-Bertin VTOL A wooden tunnel model on the Turboméca stand reveals the configuration of the HB-11 project, sponsored by the French Government as a research project. Either one 6,600lb-thrust engine or three 2,200lb-thrust engines would be used for propulsion, with bleed to two lift fans in the wings. The transition, at 112 m.p.h., has been verified in the tunnel.

Hurel-Dubois HD.34-08 (F-BICV) The eighth and last of the photographic survey aircraft still serving the Institut Géographique National, F-BICV keeps alive at the Salon the Hurel-Dubois tradition of the high-aspect-ratio wing, now revived in the twin-Astazou HD-130 (see below).

Hurel-Dubois HD-130 Still a project only, this 12/15-seat twin-Astazou design is a purely civil machine that Hurel-Dubois are aiming at operators of "underdeveloped" routes who at present use anything from the Dragon Rapide to the DC-3. It has a military counterpart, the HD-150, one of a number of French-industry twin-Astazou contenders for the Army light transport competition. The 150 will not have the high aspect-ratio HD wing, aspect ratio being ten.

Kaman H-43B Huskie Making its first visit to Europe, this Huskie (powered by Lycoming T53 free turbine derated to 725 h.p.) is one of the 100 so far made of the 150 ordered for the USAF. Although it can fill numerous roles, including transport of ten soldiers, its primary USAF task is in crew rescue for SAC. It carries externally a firefighting pack which, when used in conjunction with the rotor downwash, allows a

The prototype Potez 840, which gives the impression of being a Heron crossed with a Viscount

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path to be beaten through flames to rescue the crew of a burning aircraft. The pack is on view, but the demonstration will not be given because the authorities are alarmed at the prospects of 1,500gal of spilt petrol being ignited for the purpose. A lesser quantity would not meet the requirement, because rotor downwash alone would quickly blow out the resulting fire.

Interlocking, two-blade teetering rotors with servo-tabs twisting the blades for pitch control are reported to give good handling characteristics, and the low disc-loading allows very low r.p.m. and freedom from blade stall. Directional control is partly by aerodynamic rudders on two of the four fins and partly by differential cyclic-pitch control. The rotor is constant-speed.

A recent feather in Kaman's cap is the lifting of a 1,000kg load to 25,814ft on May 25, which set a new weight-to-height record for all classes of helicopter, including the Russian Mi-6.

The HU2K Sea Sprite rotor, incidentally, has flap and drag hinges and twisting roots, instead of twisting blades with servo-tab pitch control.

Lockheed C-130C Hercules (58-0712) This aeroplane, better known as the BLC-130, is the one-off research vehicle modified by Lockheed Georgia division to see how far field length could be reduced by flap blowing. The blow is provided by pairs of extra Allison T56s, in underwing nacelles, each driving a load compressor; after careful attention had been paid to stability and control problems it was found the aircraft could fly at below 60kt and use a 500ft runway. Lockheed have teamed with British Aircraft Corporation to produce the BAC-222 proposal for an RAF STOL transport, as described on page 732.

Lockheed Macchi Santa Maria (I-AVAL and I-PFOR) Two of the six Santa Marias so far completed by Macchi in Italy are at Paris. One has a bare cabin and the other a six-seat passenger layout; otherwise they are identical. The aircraft look rather squat with their thick wings, deep-chord ailerons, wide cabins and short-wheelbase undercarriages. Powerplant is a Continental IO-470 giving 260 h.p.

A single door to the left gives onto the third row of seats and a door on the right, opposite the middle row, forms part of a very large, upward-opening freight hatch. Main-undercarriage suspension appears to be by torsion rod, while rubber-in-compression is used for the nosewheel. Structure appears to be practical and simple. Stalling speed is below 50 m.p.h., maximum speed for flaps 100 m.p.h., cruising speed up to 140 m.p.h. and V$_{NO}$ 175 m.p.h.

There appears to be relatively little scope for future development in the design, but it is cheap (about $20,000 to $23,000 in Italy) and Macchi are planning to build about thirteen per month. Lockheed will help in selling them.

Lualdi L.59 This promising, front-engined, two-seater arrived as our report was going to press.

Macchi MB.326 Two of the ten 326s so far completed (70 have been ordered for the Italian Air Force) were due at Paris, but were still held up by weather in the south as this report was being completed. Production machines are powered by a Bristol Siddeley Viper 11 made under licence by Piaggio, and all the aircraft are painted orange all over. Some of the first ten are in service at Pratica di Mare.

Max Holste MH350 Broussard Major An unexpected project announced at the Salon is a handsome twin-engined "big brother" of the highly successful single-engined Broussard, of which some 400 have now been built. In appearance it resembles a scaled-down Super Broussard. The engines are Continental GIO-470As of 310 h.p. Seating capacity is for seven passengers and a pilot, plus 1,430lb of freight; and payload is about one ton. The complete fuselage with furnished interior is displayed outside in mock-up form. Max Holste make a point of the fact that the Major can be equipped with skis or floats, equipment that has not been available on the Broussard. The first prototype is being built at Reims and is due to fly in March 1962.

Empty weight of the Broussard Major is 4,380lb, and maximum weight of the freight version is 6,950lb. Payload-range performance allows the maximum payload of 2,000lb to be flown over 100 n.m. stage-length, or 1,500lb over 350 n.m. Wing span is 50ft, length 35ft, wing area 301 sq ft. Take-off distance at maximum weight to 50ft is 1,530ft, and landing distance over 50ft is 985ft. Maximum cruising speed is 159 m.p.h.

Max Holste MH260 Super Broussard F-WJDV is the prototype, which has now flown about 250hr. It appears in the bright markings of Royal Air Maroc, one of a dozen operators who have signified their intention of purchasing the 260 or 262 (pressurized) versions of the Super Broussard. Design of the 262 has been undertaken by Nord, who are producing 20 MH260s. Materials have been bought for the construction of five, and the first is due off the line at the end of September 1961. It is expected that the first operator will be the Postale de Nuit French domestic airmail line (an Air France subsidiary), who are thought likely to have six. Delivery of the prototype to this operator for route-proving may take place on July 1. Operators other than those listed on page 708 of *Flight* last week who are interested in the MH260 are Wien Alaska and BC Air Lines of Vancouver.

Max Holste MH262 The pressurized Super Broussard is in the "well advanced" design stage. It is expected that the first aircraft will fly in mid-1962 and be certificated and delivered in July 1963. Cost of the basic unequipped machine will be about £120,000.

Morane-Saulnier Rallyes Of the five Rallyes expected, only two, a production 100 h.p. 880 and the first 140 h.p. 885 (respectively the third and fourth off the line at Tarbes) had arrived last weekend. The 885, with an aileron wheel replacing the usual floor-mounted stick, is to be demonstrated in the USA immediately after the Salon. Both aircraft

The Potez-Heinkel CM.192, below, is obviously derived from the Magister, which has long been licence-produced in Germany

Military ancestry is perhaps also evident in the CM.192 cockpit, which in spite of being severely functional is extremely comfortable and well equipped

were brightly painted in typically graceful Morane motifs. The structure now includes extensive spot-welding.

Sales are still increasing, but no longer at the spectacular rate of five months ago. The vast majority ordered are of the 140 h.p. version. One Rallye was recently destroyed during spinning trials at extreme aft c.g., but there is no indication that this loss will seriously delay development.

Morane Saulnier MS.760C Paris III The Paris II, with Marboré VIs, has considerably better performance than the Paris I. It also has a second generator, electrical de-icing of intakes and engine-intake bullets, an additional 94gal in integral tanks along the whole leading edge, and a strengthened undercarriage allowing an increase in gross weight from 7,700lb to 8,600lb. Five Paris IIs have been sold, two of them in Germany.

A surprise at the Salon is the Paris III, which incorporates all the new features of the Paris II, but has a five-seat cabin with a car-type access door to port instead of the sliding canopy. Window area has also been greatly reduced. The III can be made in the same jigs and could be put into production very quickly. The freedom of movement in the cabin—4ft 3in wide—and the new atmosphere created by side-door and "solid" roof should prove a highly effective selling factor in face of the new competition from other executive jets. The Paris III could also be available some time before the others.

Nord 1500-02 Griffon 2 Now being used by Nord for kinetic-heating research in connection with a supersonic-transport project, this hard-worked and unique research aircraft has heat-sensitive paint, temperature-sensing points and plastic overlays on various parts of the left wing, fixed-incidence foreplane and nose. The windscreen now also consists of four flat panels of very thick glass, this having been the first part to yield under heating at the M2.25 speeds attained. Test pilot André Turcat brought the Griffon in on Saturday and made several runs with the ramjet billowing an enormous, gently rumbling flame. The turbojet component is an Atar E3.

Nord 3400 Examples of this French army observation aircraft are in the static park and, partly dismantled, in the exhibition hall.

Nord 3202 Two examples of this French army trainer are on view in the static park.

Piaggio P.166 (I-PIAK) The Piaggio demonstration aircraft is in the static park.

Pilatus Porter (HB-FAD with Astazou; HB-FAZ standard) The standard Porter is an efficient aircraft, but at high altitudes the Astazou gives better performance for a lower fuel consumption than does the supercharged Lycoming. Despite greatly increased power, the empty weight has increased by only 20lb. Gross weight has been increased from 3,970lb to 4,320lb and, at the new gross weight, take-off to 50ft is only 13ft longer at 738ft. Cruising speed is 158 m.p.h. at 9,800ft instead of 125m.p.h., but endurance and range are down from 6hr and 746 miles to 3¼hr and 500 miles. Flying from Geneva to Paris the Lycoming-engined Porter took 2hr 35min at 6,000ft and used 170 litres of 100-octane fuel. The Astazou-engined Porter took 1hr 50min at 14,000ft and used 200 litres of cheaper kerosine.

The price of the Astazou, and particularly of the propeller version, is still rather high, but when compared with the short life of the supercharged Lycoming at full power, the difference is not so marked. Direct performance comparison is very significant. Pilatus at present have no firm plans for production of the Astazou-powered version.

Piper Cherokee (N 5007 W) The first Cherokee in Europe, just assembled by Vigors Aviation at Oxford Airport, reached Paris minutes ahead of the Airedale. With low-set wing, slab tailplane and fixed undercarriage it is in the modern style and should very well replace the Tri-Pacer. With its sumptuous comfort it should also hold its own well in a European market which is producing more and more aircraft of this class. Piper are represented in Paris by Jonas Aircraft, a company now based on Paris, but soon to move to Geneva. Jonas are exhibiting several of the established Piper range, including the Aztec, Comanche and Super Cub.

Potez-Air Fouga Magister (F-BJDX) This is one of the prototype Magisters fitted with Marboré VI engines. Six of a batch of 100 have now been completed for the French air force. No structural alterations are required to accommodate the more powerful engines, which increase top speed to 450 m.p.h. and maximum attainable Mach number to 0.83. Service ceiling is 40,700ft.

Potez Heinkel CM.192 The prototype is mounted on the Heinkel stand and will not make its first flight until August or September. Although it is at present equipped for flying training, Heinkel feel that no civil market exists. Under the sliding canopy there is reasonable room for four comfortable seats and the cabin is pressurized at 9,000ft so that oxygen is not necessary. Instruments (including two full blind-flying panels) are well arranged, with a battery of electrical switches, Lear ADF-102 and ARC-34 UHF across the lower edge of the panel. Controls are well distributed, systems being basically the same as those of the Magister, on which most of the airframe is based.

The 192 can operate from grass fields. Either 33 or 60 US gal tip-tanks can be carried to allow respective ranges of 1,156 miles and 1,318 miles, and endurance of 3hr 49min and 4hr 25min. A cabin tank replacing the rear seats will extend range to no less than 1,650 miles. With the 192 clean, cruising speed at 20,000ft is 358kt. Gross weight varies between 8,479lb and 9,780lb. Cost of a 192 with basic instruments is DM900,000 (£81,000) and deliveries are to begin in 1962. Several options have already been taken. Heinkel will sell the aircraft everywhere except in French territory, where Potez will officiate. Production will be in Germany.

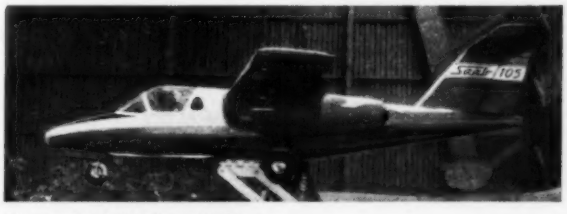
Potez 840 (F-WJSH) First flown on April 25, since when about 40 flying hours have been logged, the Potez 840 occupies a prominent place in the aircraft park and is giving regular demonstration flights to potential customers. No firm orders have been announced, though it is said that Mr Don Payton, president of Turbo Flight Inc, an American business corporation, is prepared to place an order for 25. In any case, Potez, who are financing the programme, have decided to lay down a production batch of this quantity. The second 840 is expected to fly in September; this aircraft will differ in its equipment, and weather radar will be fitted in the nose. Price of the production aircraft is quoted as "less than $400,000" (£150,000), and delivery to a commercial operator could be achieved by "the beginning of 1963." A military version is also being developed, though no details are available.

The 840 is designed primarily as a civil transport aircraft, and the executive market is obviously potentially promising. In appearance it is reminiscent of a scaled-down Viscount, the extremely clean Dart-like nacelles of the four 550 h.p. Astazou turboprops and their Ratier-Figeac propellers strengthening the resemblance. The reasons given for the choice of four Astazous instead of two Bastans are: superior performance in the engine-out case; passenger preference; ease of ferrying back to base, following an engine failure; superior reverse-thrust performance for landing (quoted as 800ft); and, with the use of 60° of flap, maximum exploitation of slipstream effect. Potez are putting special emphasis on their ability to support the 840 with a comprehensive after-sales service.

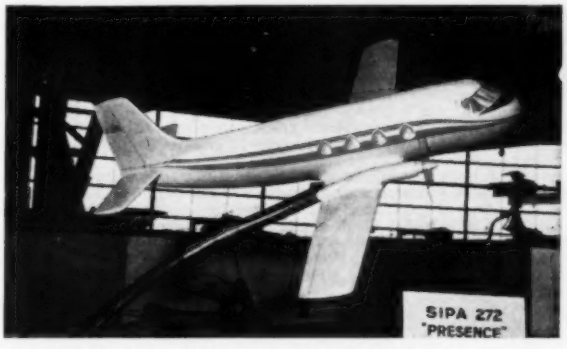
Procaer F.400 Cobra (I-COBR) The prototype of Stelio Frati's latest design is in Paris, having obtained its Italian C of A on May 20. It is powered by a Marboré II, giving a maximum speed of 360 m.p.h. at 13,100ft and endurance of 1hr 50min at 236 m.p.h. at the same height. A pre-production batch is to be begun in September for delivery in 1962; price, including Narco Mk V VHF and ADF-29, blind-flying instruments and oxygen equipment, will be LIt 50m (£29,000).

Procaer F.15B Picchio (I-PROC) Full aerobatic demonstrations are being given by this exhilarating 180 h.p., four-seat tourer. Ths F.15B version is the latest, with all-metal moving surfaces, tankage in the wings only and other detail improvements.

Rhein Flugzeugbau RW.3 Passat (D-ELYL) An improvement of the Porsche-powered Multoplan, the Passat has a 150 h.p. Lycoming O-320



The new Saab-105 in model form



Above, model of the S.272 Presence, with two Astazous
Below, the model Super Caravelle, also portrayed overleaf

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Left, the dramatic and unexpected model bearing the legend "Super-Caravelle." Although a visitor's first reaction might be "at least we know now what it does not look like," it is said that the configuration is quite genuine

engine, electrically retractable undercarriage, larger wheels, hydraulic brakes, all-metal rear fuselage, adjustable seats, and other refinements. The 15ft wing extensions can be quickly fitted for flying at 21,000ft, towing gliders or gliding at 1 : 26. Cruising speed is 155 m.p.h., endurance 4hr and useful load 680lb. Gross weight is 2,200lb. The basic aircraft, without night lighting or wing extensions, costs DM38,000 (£3,400). An electric variable-pitch propeller is an optional extra.

Saab 105 The prototype of this new twin-jet project is being built at Linköping, the target date for first flight being early 1963. It is designed primarily as a military and civil trainer and liaison aircraft, but is also considered to be a contender for the light twin-jet executive transport market. At present Saab are emphasizing its military role, with a particular eye on a requirement for the Swedish Air Force. A model on the Saab stand indicates also the potential of the 105 as a light attack aircraft, with an ability to carry a variety of external weapons and stores. At present the project is being entirely financed by Saab, though strong Government interest is said to have been expressed.

The pressurized cabin provides for two pilots side by side and seats or a bench for two or three passengers behind. Propulsion is provided by two of the new Turboméca ducted fans of 1,540lb thrust each. The one-piece wing is mounted on top of the fuselage, and the engines are in the sides of the fuselage. Total fuel capacity in two integral wing tanks and two integral fuselage tanks is 310 Imp gal. Cabin pressure is 4.3lb/sq in. Provision for radio covers duplicated VHF, ADF, ILS and VOR equipment. Maximum take-off weight of the aerobatic-category aircraft is 7,720lb, with 8,820lb—1,000lb more—scheduled for the ground-attack version. Maximum landing weight is 7,750lb, and manufacturers' empty weight is 4,450lb. Wing area is 175 sq ft, wing span 31ft 2in, length 35ft 5in, wheel track 6ft 7in; and wheelbase 12ft 9¼in; cabin width at elbow level in the front is just over 4ft, and just over 4ft 2¼in in the rear. Take-off distance to 50ft (at an all-up weight of 8,160lb) is 3,350ft, balanced field length being 4,200ft. Maximum speed at take-off thrust is 490 m.p.h. with a max continuous cruising speed of 440 m.p.h. Normal cruising speed would be 370 m.p.h., with an endurance at this speed of 3.8hr.

SAN DR.1051 Ambassadeur This Potez E4-powered Jodel Ambassadeur in glossy brown and white arrived unexpectedly on Saturday.

SFERMA Beech PD.146-01 Marquis (F-WJHC) This fine project is now an accomplished fact, the first true Marquis having been delivered to M. Szydlowski of Turboméca a few days before the show opened. The first prototype, F-WJHC, started life as a Travel Air, but now has the long, swept fin and dihedral tailplane of increased span which characterize the true Marquis. The long engine nacelles and eight fuel tanks in the wing considerably improved airframe strength, and only about 20lb of stiffening in rear fuselage and wing root were needed to allow for almost exactly doubled power of the Astazou in relation to the Continental piston engines.

The Marquis now cruises at 267 m.p.h. at 9,000ft and can carry fuel for 870 miles, five occupants and over 150lb of baggage. Take-off run is a startling 165yd, and a rate of climb of 3,000ft/min can be maintained up to 10,000ft. Single-engined rate of climb is over 1,000ft/min. Pitch settings now marked on the power-lever quadrant are a flight-idle, which gives zero thrust at 90kt; 23°, which allows level flight clean or 500ft/min descent at 100kt with gear and flaps down; and 35°, for full climb at 110kt.

A 35Ah battery allows independent starting; and full safety devices, including under-power, overheat, electrical-fault isolation and automatic or manual feathering controls, cover almost all possible operating and handling faults. The engines can easily be relit in flight and air and fuel shut-offs at the nacelles are provided, as well as extinguishers and flame-proof cowlings. The fuel system is entirely automatic. Minimum single-engined control speed is 80-85kt, from which the acceleration on one engine is very fast. Full power is obtained at the pressing of a button. Powerplant apart, the Marquis retains all the traditional comfort of the Baron. As a next step, SFERMA are planning an all-a.c. electrical system which will eliminate the need for power packs in radio and instruments.

Short SC.5 Belfast Displayed on Short's stand is the new freight terminal cargo-handling system designed by the company for the Belfast. Described in *Flight* for May 11, page 648, some more facts are available about this method of making the maximum use of the Belfast's 100,000lb freight capacity. Delivery of a civil version, which has a swing nose instead of a rear loading door, could be made early in 1965 for orders placed this year. Principal innovation is the provision of two loading tiers of pallets, which are loaded straight from the terminal pier simultaneously. The main lower floor, 73ft long, is of light construction and carries three roller-ways on to which pallets are loaded. On each side of the fuselage at a height of about 6ft are two longitudinal lines of inbuilt rollers into which pallets, stabilized with cages, can be inserted. Ten or more pallets can be installed at this upper level, the number depending on galley and toilet facilities. This method of loading permits full use of the internal volume employing pallets no higher than the optimum building-up height of 6ft. Provision of a swinging nose enables the entire hold to be loaded in one operation.

The display illustrates also the capability of the Belfast as a mixed passenger/cargo freighter, a type of aircraft for which Shorts expect an increasing interest. The Belfast could make it possible to offer a one-way passenger fare across the Atlantic of £30 while carrying 55,000lb of freight. Corresponding seating capacity would be 138, the chairs being mounted six-abreast on pallets inserted on the upper rails.

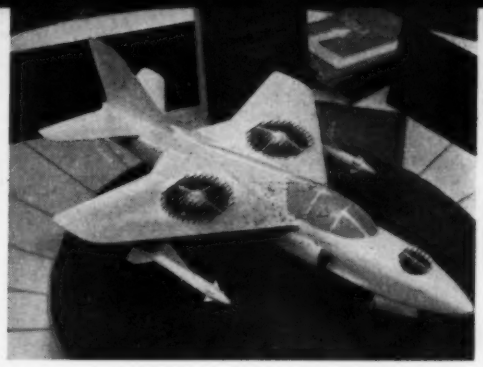
SIAI Marchetti FN.333 Riviera During the two years since the last Salon this type has undergone many trials and tribulations, but it is now established in production. The example in the static park is highly polished and attractive.

Sikorsky HSS-2 A US Navy production example first unfurled its rotor on Saturday and began demonstrations.

Sipa S-272 Présence Until the opening of the Salon very little was known about this twin-Astazou light transport, freighter and executive aircraft. A full-scale mock-up is on show outside, but no prototype is being constructed until market reaction has been assessed. The Présence is primarily intended for commercial operators, though its military significance is evident in view of the important French Army requirement for an STOL light transport in this class, for which competing tenders are now being made.

An unusual feature in an aircraft of this size is the provision of a swing nose, enabling full use to be made of the 635 cu ft useful volume of the pressurized cabin. Cabin height is 5ft 6in and maximum width 7ft, the external cross-section being circular. The floor is 21ft 4in long and

Biggest aeroplane currently flying, and outclassed in weight only by the B-52, Tupolev's vast type 114 is now in scheduled service



Left, "Flight" samples the Gyrodyne Rotorcycle; right, the lift-fan, V/STOL attack model displayed by General Electric

a range of car-size vehicles can be accommodated. The mock-up on display is fitted with 12 seats three-abreast; another passenger version accommodates 16 seats facing inwards along the sides, in the configuration set by the Potez 840.

Wing span is 57ft, length 45ft 7in, and wing area 355 sq ft. Empty equipped weight of the cargo version is 6,380lb, and of the transport version 6,600lb. Maximum weight is 10,740lb, useful load, depending on empty weight, varying from 4,100lb to 4,350lb. Cruising speed at 20,000ft is 223kt, and take-off distance to clear 50ft is put at 1,754ft. Maximum range is quoted as 1,550 miles.

Sac 11G Super Courlis A number of Courlis twin-boom, pusher-engined airframes dating back to the 1940s are still available, and this conversion to Continental 240 h.p. engine produces a pleasant and efficient touring or utility aircraft at low cost. A payload of 660lb can be carried at a cruising speed of 137 m.p.h. for 530 miles. Take-off and landing distances are both under 660ft.

Sud-Aviation Alouette III At least three of the four so far built are at Le Bourget, one on the field and another in the little French army ALAT display.

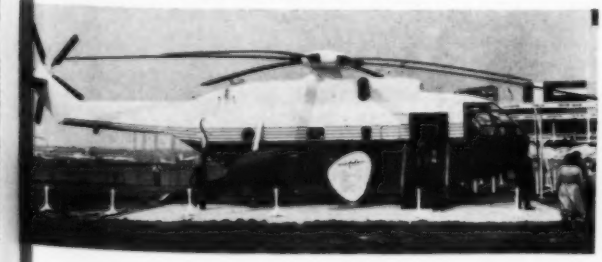
Sud-Aviation (North American) T-28 The 109th T-28 converted for French use in Algeria by Sud is in the static park—curiously bearing USAF insignia and French servicing instructions. It carries four underwing pylons which can accommodate SFERMA-made twin 0.5in gun-packs.

Sud-Aviation 3210 Super Frelon A full-scale mock-up of this development of the Frelon, representing the definitive configuration, is in the static park. It has a boat hull, outrigger floats over the mainwheels, a rear loading ramp, hand-folded six-blade rotor with full hub fairing and three Turboméca Turmo IIIC free turbines giving 1,300-1,500 h.p. each. Production is foreseen, under the *Loi Programme*, two years from now; and German and Italian companies will participate in manufacture, whether or not those countries adopt the type. Recent discussions indicate that the Super Frelon has been offered to the Germans.

Possible applications include transport of vehicles, freight, passengers or stretchers, and towing, minesweeping and anti-submarine work. An autopilot is contemplated. Rotor diameter is 62ft, empty weight 13,200lb, normal gross weight 24,250lb and maximum gross weight 25,350lb. Maximum and cruising speeds will be respectively 135kt and 119kt; hovering ceiling out of ground effect will be 9,200ft. By virtue of existing Sud-Sikorsky agreements, the American company have an increasing share in the Super Frelon.

Sud-Aviation Caravelle 7 General Electric are showing the Caravelle 3 which they converted last year to Caravelle 7 standard with two 16,100lb CJ-805-23 turbofans, powerplant of the Convair 990. For many months TWA have shown a strong interest in this version of the Caravelle, which could be delivered a year ahead of the JT8D variant. (It is possible that, in order to obtain early delivery of Caravelles—perhaps in July or August of this year—TWA may buy Avon-powered aircraft.) GE have completed about 100hr flying, with a view to FAA certification by September 1961. Intake performance under maximum yaw of 17° has been found satisfactory, aircraft balance has been found virtually unaffected, and GE say that the test programme has proceeded without any setbacks. The company has a contract with Sud-Aviation to supply two complete engine nacelles, plus a spare engine, for installation in the first of four Caravelle 7s now being built at Toulouse. This aircraft is due to fly in February of next year, and production deliveries could be made in July or August of 1962. The four are being built by Sud-Aviation on speculation. So far 113 Caravelles have been ordered, and 76 delivered, and Sud are considering authorizing a further batch on top of the 160 for which materials have been ordered. Normal delivery date being quoted for a Caravelle 6 is four to five months, and April or May 1962 for the improved Caravelle 6R.

Mock-up of the SA.3210 Frelon, likely to become the basis of a joint Sikorsky-Sud-Weserflug helicopter for military use



Sud-Dassault Super-Caravelle Perhaps the most unexpected revelation of the entire Salon is the display by Sud Aviation of a model of their M2.2 supersonic airliner project. The wing is of the ogive "Gothic-delta" configuration, widely held in Britain to be the optimum plan-form for this Mach number. There is no sign of a canard foreplane, control being provided by ailerons, elevons and rudder. Sud say that the model is exactly representative of the layout which current research is intensively exploring. No details are being published to add to the bare facts and figures already issued (see last week's issue); reports that the powerplant will be Snecma-built Pratt & Whitney JT-11s (designated M-35) are not discounted, but Sud emphasize that British powerplants are under study, both Rolls-Royce and Bristol Siddeley having made detailed proposals. Pratt & Whitney have also made a direct proposal, and the presence of a JT-11 at the Salon is obviously not without significance.

The design work so far has not been Government-financed, but rate of expenditure is obviously about to rise sharply, and this is the type of prestige project very dear to the French President's heart. Independent Sud and Dassault design studies are now being evaluated, and when a firm decision is reached a Government contract will be signed for further research into the more promising project. Whichever company's design is chosen, both Sud and Dassault will from that stage work together, and the urgency with which the programme is proceeding can be gauged from the fact that M. Georges Hereil, Sud's president, hopes for a first flight early in 1965, and scheduled service in 1967. Dassault are showing nothing of their supersonic project—nor are Nord, who are also participating with flight-test research by the Griffon. It is thought that before the end of the show there may be an official announcement about the progress of this enormous and ambitious programme.

Transall C.160 First flight of this Franco-German twin-Tyne transport is expected "during 1962." Three prototypes are being assembled by Nord; fabrication is shared by Nord (wing and powerplant-build) and the three German companies (fuselage and tail) in the Transall group. One static-test specimen and one for fatigue-test are being built also.

This aircraft is known correctly as the C.160—not as Transall, which is the name of the manufacturing consortium.

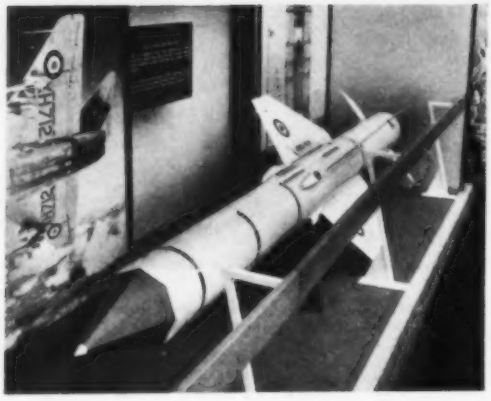
Tupolev Tu-114 (76470) According to one of the crew that brought the 114 to Paris, ten are now in service with Aeroflot, with "more for delivery every year." First passenger service (Moscow-Khabarovsk) was on April 24; cruise is at "about M0.7." External impressions are good skin finish despite a very large amount of close-pitch riveting along stringers, seams and spars. There is no sign of bonding or of integrally machined wing skins. Undercarriage structure is roughly finished, with a typically Russian amount of welding. The huge contra-rotating propellers are no longer roughly buffed, but finely finished and blue-dye anodized—and as we went to press we were still wondering how it was we were able to push both units of one propeller freely round by hand in the same direction.

Tupolev Tu-124 An example of this new short-haul Aeroflot turbofan was expected at the Salon, but—like the An-10 and An-24—had not arrived as this went to press.

US Air Force types Republic F-105 Thunderchiefs are now beginning to arrive in Europe. The first was flown over by Lt Retterbush, who is in Paris as custodian of F-105D number 60-0436. His unit is the 36th Tac Fighter Wing at Bitburg, and the aircraft at Paris is the wing commander's, with all three squadrons' stripes on the fin. Equipment in the new D model includes Nasarr fire control and a doppler radar, which permit practically any type of mission to be flown under any weather conditions. Next to the big Thunderchief is a Lockheed F-104C Starfighter (56-0894), flown up from the Tactical Air Command base at Moron, near Seville. Externally very similar to the 104As seen at Paris in 1959, the 104C can carry a wide variety of stores, can fly at 135kt in a slow pass and then accelerate under full power while pulling a tight 360° circuit and come out of the turn at 510kt and go straight into a loop—"but," said the pilot at Paris, "I'm not allowed to do it here." A rather different aeroplane is the Douglas C-133A Cargomaster (54-137A), which is a standard MATS workhorse from Dover, Delaware. Close by is a North American T-39A-1-NA Sabreliner (60-3478A), outside the USA for the first time. USAF Air Training Command are due to receive nearly 100 T-39s, all but six of which will be standard navigation and crew trainers. The exceptions are the T-39Bs, equipped with Nasarr in the nose and a doppler radome aft. Another Air Training Command aeroplane at Paris is a Northrop T-38A Talon (60-0551), which is quite standard and has been demonstrating a breathtaking performance.

US Army types New to Europe, Grumman's AO-1 Mohawk looks very pert in glossy khaki emblazoned with hundreds of white, yellow and red stencilled inscriptions—one of which reads "oxygen filler—fill with oxygen." The aircraft is actually an AO-1AF (aircraft 60-3731f), without the APS-94 side-looking airborne radar. Close by is a de Havilland Canada U-1A Otter (55-3282), the placard beside which gives the price as $80.000.

SALON EXTRAORDINAIRE . . .



Two revelations by de Havilland Aircraft: right, the exhibition Red Top air-to-air missile, derived from the widely used Firestreak; far right, a model of a three-stage spacecraft-launching system using Blue Streak as the first stage

US Navy types Anchored off Italy, USS *Forrestal* has sent five aircraft to Le Bourget to fly the flag of the Sixth Fleet in Paris. They are: Chance Vought F8U-2 Crusader (aircraft 146906 from squadron VF-103); Douglas F4D-1 Skyray (9065 from squadron VF-102), carrying a probe buddy pack; Douglas A4D-2N Skyhawk (147806 from squadron VA-83); Grumman S2F-3 Tracker (147533) and Grumman WF-2 Tracer (aircraft 404 from squadron VAW-12). But for technical interest these ships of the line are outshone by the two that have come from the Naval Air Test Center at Patuxent River, Maryland: a North American A3J-1 Vigilante (147852) and a McDonnell F4H-1 Phantom 2 (146819). Both these aircraft are powered by twin GE J79 turbojets with reheat, both are capable of exceeding M2, and neither has been seen in Europe before.

Weserflugzeugbau-Sikorsky WF-S 64 A full-size cockpit section of this German-American crane venture is displayed on the German industry stand, clearly showing the three-man crew configuration of two "manual" operators facing forward and one autopilot operator facing aft. The latter has only a stick-top cyclic autopilot controller and collective autopilot lever, allowing him to fly the crane, watching the load aft of and below him. Two prototypes are being built by Sikorsky for Weser, and German military orders are sought.

Powerplant is two P & W JFTD-12A turboshafts giving, in early versions, 4,110 s.h.p. each. The transmission is limited to a total of 5,480 h.p. so that take-off power can be held up to a height of 14,200ft. Early S-64s will fly level on one engine: later versions will be able to deposit their load with one engine. Load-to-gross weight ratio is 53 per cent and maximum hook load is 17,600lb. The S-64 will have sufficient stability and manœuvrability to land astride its load for 85 per cent of all missions, even in gusty air; otherwise a winch is available. With a load having a parasite drag-producing surface of 120sq ft, the S-64 will climb vertically at 487ft/min. or inclined at 1,510ft/min. With a streamlined pod it will cruise at 166 m.p.h.

Engines

Flygmotor ramjet Svenska Flygmotor have now been permitted to display their RR2 ramjet in fully sectioned form. This unit is 10.24in diameter and 63in long, and is designed for flight at from M2.2 to M3, giving 2,700lb thrust at the lower speed at 6,500ft. Unusual features include upstream injection against six concentric rings of straighteners, an annular flame-tube with vee-gutters at the leading edges of the air holes, and a turbopump intake in the tip of the intake centrebody, the cone angle of which is designed for M2.8. "In the version exhibited," say Flygmotor, "there are no ceramics or refractory coatings." They have a technical agreement on ramjets with Bristol Siddeley.

Focke-Wulf jet-lift A model suggests how six unnamed Bristol Siddeley lift fan engines might be fixed vertically in a slender wing nacelle to provide a subsonic transport with VTOL ability. Wool tufts are provided to show the effect of deflecting the nozzles through a limited fore-and-aft range, to assist transitions.

Potez 6E Closely related to the well-known 4E, this is an entirely new flat-six, with a swept volume of 5.13 litres, a weight of 275lb and a maximum rating of 155 h.p. The fuel is 100/130 grade, fed through a Zenith direct-injection carburettor.

Pratt & Whitney Biggest surprise is the JT-11 turbojet, the commercial form of the mighty J58. The latter is a turbojet, originally sponsored by the Navy, which was designed for flight at M3 and above and has been extensively tested at Palm Beach with a variety of afterburners, intakes and nozzle systems. Ratings are classified, but are known to reach the 40,000lb level with full augmentation. In contrast, the JT-11 is conservative in having a dry rating of 23,000lb. The function of acting as second-string back-up to the J93 for the B-70 no longer exists, but Pratt & Whitney are maintaining development at a substantial rate, for the JT-11 is regarded as a "workhorse" development unit for supersonic commercial applications. A great deal of attention is being paid to high-temperature operating problems, structures and installational design. The engine has been linked with the Super Caravelle, as noted on page 741.

A mock-up of the JT8D-1 enables an instructive comparison to be made between this very important new turbofan, chosen by Boeing for the 727, and the somewhat smaller Spey, displayed for the first time by Rolls-Royce. The American unit is a little further back in timing, the first development engine having run only a month ago. Two are now on the bench, development units are steadily being produced and the first flight, under a B-45, is likely to take place at the end of the year.

SNECMA Most important French aero engine, the Atar won its fight for adoption by the RAAF as the powerplant of the Australian Mirage III. Chief factor in this success seems to have been SNECMA's ability to wring yet more power out of the engine, the uprated unit being designated Atar 9K (first reported in last week's issue). The Australians have been understandably apprehensive of any airframe changes, and this has been avoided by retaining installational interchangeability between the 9K and the present 9C. What SNECMA have done is to achieve transonic flow through the front of the compressor, by replacing the existing i.g.v.s., and the first two rotor and stator stages. A number of alterations have been made at the hot end of the engine, the flame-tube having rearranged secondary air holes and the turbine rotor blades being of an improved vacuum-cast material of the Udimet 700 type.

The resulting unit has a mass flow raised from 150 to 159lb/sec and a specific consumption "from three to five per cent better than that of the 9C." Guaranteed minimum ratings (sea-level, static) are 10,360lb dry and 14,770lb continuous with reheat. The engine first ran on the bench at Melun on April 15; during the past two weeks it has demonstrated short-period thrusts of 11,020lb dry and 15,430lb with reheat, and Australian representatives are watching progress. Delivery of production engines is scheduled to begin in November 1962, by which time SNECMA expect to incorporate titanium alloys into the engine.

As licensees of Pratt & Whitney, SNECMA are manufacturing spares for the JT3Ds and JT4As of Air France, TAI, KLM and UAT, and are anxious to make JTF-10s. Although it has no home in the USA, the JTF-10 turbofan, derived from the J52 turbojet, is being very actively worked on by SNECMA for both conventional and VTOL applications. One example has been running at Melun since mid-March. TF-106 is the designation of an advanced JTF-10 derivative, with tilting jetpipes for VTOL lift. Ratings are 11,240lb dry and 19,840lb with reheat; and the extraordinary reheat augmentation of 77 per cent makes it clear that burning in the by-pass duct is specified. The TF-106 could run inside two years.

Turboméca Notably absent from the Salon is the new by-pass engine, rated at 1,700lb, now under development for the French Air Ministry and chosen for the Saab-105. The only new powerplant is the Aquitaine air compressor, utilizing parts of the Astazou II and also having a shaft-drive capability. Latest turboprops are the 1,000 h.p. Bastan IV, which flew last year and received initial certification in January, and the Astazou II Special, in which raising the flame temperature and polishing the guide vanes have increased output to 595 b.h.p.

Missiles and Space

Berenice This is the name of a high-altitude research vehicle by ONERA, and the exhibit appears much less like flyable hardware than do ONERA's smaller vehicles, such as Antares. Berenice is a formidable four-stage device, designed to reach 7,950 m.p.h. (M12) and lift 66lb payload to 746 miles altitude or 220lb to 466 miles.

Latécoère The Marine Nationale's surface-to-underwater missile is designated Malafon Mq 2, Mod 1, and the 50th example is on view. It carries an acoustic-homing torpedo and manœuvres by spoiler ailerons and elevators. Latécoère Type 21.0 is a red-and-white two-stage rocket, which weighs 331lb, and carries a 22lb payload at 1,300 m.p.h. with guidance by a cruciform of moving wings. Latécoère Type 258 is a Malafon-derived vehicle carrying a 1,544lb useful load a distance of 43 miles at 560 m.p.h. It has an autopilot, radio-command guidance and a TV camera

Marine Masurca After once having a whole crop of surface-to-air missiles under development, the French now have only one active project likely to produce usable hardware in this field: the Masurca, developed by the Marine Française at Ruelle Arsenal. The actual missile is seen at Paris for the first time, although its appearance has long been known. A slender, two-stage weapon, the Masurca on view is designated Mq 1, Mod 2; it has a silver-painted booster, and the missile itself is bright yellow, apparently a chromated anti-corrosion finish, with numerous red stencils. There are four canard foreplanes and four fins, two of which have anti-roll controls.

Matra R.530 This is the definitive air-to-air missile of the Armée de l'Air, and is scheduled to be standard equipment in all Mirage III squadrons. It is a much more business-like weapon than the twist-and-

steer R.511, and has cruciforms of delta wings and tail controls. Propulsion is by a two-stage solid internal motor, and the "*autodirecteur*" in the nose can be either an IR seeker or a semi-active radar head. Aft of this package, which is a product of SAT and has a hemispherical nose, comes the conventional warhead and the proximity fuze (the four axial aerials for which were deleted from the exhibition missile). Next follow the autopilot, the electric batteries, upper and lower cable fairings (falsified on the exhibit) and the motor. Wings and fins are made like those of an aeroplane, and one pair of wings have ailerons to hold roll to a prescribed level. Matra emphasize that IR and radar versions are of equal importance, and state that trials at Colomb-Béchar have so far been very encouraging. All firings have so far been from Canberras and Vautours, but launchings from the Mirage III will shortly begin.

Nord Having delivered more than 60,000 missiles by last January 1, Nord are now in production with five distinct families of weapon. SS.10 is used by nine countries; SS.11 and AS.11 is in volume production both for inventory use and to form the first stage in training pilots to use the supersonic missiles; SS/AS.12 is completing development and is used with wire guidance up to 230kt launch speed (land forces and helicopters) and with radio at up to the maximum of 320kt (Alize); AA/AS.20 is widely used by Vautours, Super Mystères, G.91s and other aircraft; and the big AS.30 is perfectly suited to the Mirage III and should find a wide market. AS.30 is also well adapted to the F-104G, but is too heavy for the G.91. At present it is only an Armée de l'Air weapon, but talks are being held with the Aéronavale for possible issue to Etendard quadrons.

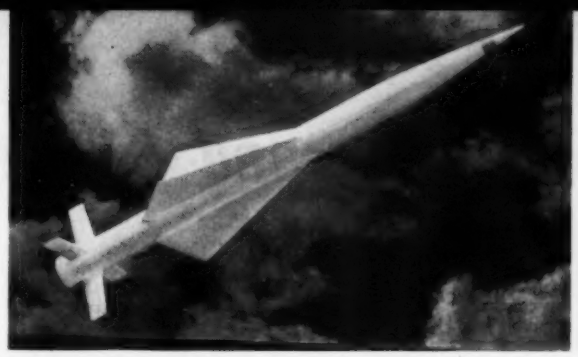
Postal rockets Painted blue and yellow, two examples of the French "mail-delivery" rockets recently tested at Colomb-Béchar are on view outdoors. One, labelled "C.06," has a tandem boost motor; the other, "B.07," is without boost. These rockets are launched at 75° elevation on a fixed trajectory.

Red Top It is not often that a major British development is unveiled at Paris, but this has happened in the case of the new air-to-air missile by de Havilland Aircraft (formerly de Havilland Propellers). Its ancestry from Firestreak is obvious, but closer inspection reveals certain marked differences which suggest a radical redistribution of internal equipment. In their officially cleared statement, D.H. relate how increasing bomber performance is making it much more difficult to achieve a hit under the most adverse conditions, and explain how the introduction of new techniques has led to this new missile with "greatly enhanced capabilities." In fact, although much of the existing Firestreak—including the basic aerodynamic configuration and the infrared homing head and guidance system—has been retained, the effectiveness of Red Top is probably outstanding, and should represent a greater advance on the earlier weapon than external appearance suggests.

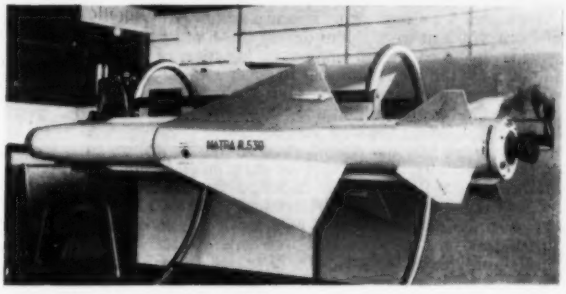
The first feature that strikes the eye is the increased size of the wings and control fins, which have substantially increased span and tapered outer portions to give better flight behaviour, particularly at extreme altitude. The wing span is now about 36in, compared with 29.4in for Firestreak. Body diameter remains 8.75in, but the forward portion does not taper; instead, the cylindrical shape is maintained all the way forward to the nose, which is composed of eight optically flat glass panels covering the seeker head. The fairings which cover the control wires of Firestreak are absent, suggesting that the complete control system is repackaged at the rear. A logical deduction would be that the warhead has been moved to the front, especially in view of the probable bigger motor and the additional internal volume made available at the front of the missile. No fuzing windows could be seen on the Red Top exhibited. One is left to wonder whether Red Top follows a collision-course trajectory—which would be obvious to assume—and whether it can carry a nuclear warhead.

It was announced last week that de Havilland have started to collaborate with the Soc Matra in the fields of guided weapons and electronics, and Matra are to produce the British company's Acorn automatic checkout and recording equipment. In view of Matra's R.530 missile (*q.v.*), which in one form is a radar-guided weapon, it would be logical to expect the two companies to share their experience in producing a standard air-to-air missile for NATO, available in both IR and radar forms. After talking with both companies it became clear that this is, in fact, quite a possibility, with obvious advantages to the customer. The D.H. IR guidance is almost certainly the more highly developed of the two heat-homing systems, but de Havilland have no experience with radar guidance.

Although Rolls-Royce have not yet actually begun to manufacture Continental piston engines, this 260 h.p. example of the flat-six IO-470 has "R-R" valve covers



Short Seacat 2 in model form



Matra R.530 for the Armée de l'Air

Saab GW systems While purchasing such foreign missiles as Bloodhound, Sidewinder and Falcon for service, the Swedes are by no means allowing their own technology to rusticate. Even in the air-to-air field they have maintained an extensive design and development programme, which could well lead to a very advanced weapon. Design of such missiles is handled by the government's Robotbyran, but industry is brought in on the manufacturing side and Saab are exhibiting various items from the control system of one air-to-air project. Included is a pair of RM23 rate gyros, an RM24 two-axis accelerometer, an air-data compensator feeding Mach number and altitude to a YX9 amplifier, load-factor and angle-of-incidence limiters and an output to two PH11 hydraulic servos. Saab also show the XA82 electro-pneumatic control system of the earlier Robot 304 air-to-surface missile, now in service with A-32A squadrons.

It is appropriate to note that the Saab-35 family of Draken intercepters has recently been extended by the introduction of the Hughes Falcon missile. The variants so far divulged are: J-35A, in service with Rb-324 Sidewinders; J-35B, with collision-course fire control and Rb-324; J35C trainer; J-35D, with RB.146 engine; J-35E reconnaissance version; and J-35F, with a new collision-course system and a mixed clutch of Rb-327 (radar-guided Falcon GAR-3A) and Rb-328 (IR Falcon GAR-4).

Short Seacat 2 This private-venture development of Seacat Mk 1 has hitherto been a well-kept secret, and even now all the company are prepared to do is display an accurate model without comment. One of the models appears to be about life-size, the length and span being some 78in and 20in respectively (corresponding figures for Seacat 1 are 58in and 26in). The most obvious difference between the two Seacats is that Mk 2 is designed for a much higher performance, with supersonic speed and obviously greater range. It is logical, in view of this, for the aerodynamic configuration to be completely changed (see illustration), the second-generation weapon having a circular-section body carrying four fixed wings of acute taper and low aspect ratio, and four rear control fins. Again the propulsion appears to be a two-stage solid internal motor. Shorts are allowed to state that a lot of Seacat 1 equipment is embodied in the new weapon system, and probably most of the changes are confined to the missile itself. Doubtless a Tigercat 2 could also be produced, and models show new Tigercat 1 launchers. Another model illustrates a ship installation of Seacat 1 matched with an entirely new radar from NV Hollandse Signaalapparaten.

US "Space and Peace" Inside a big geodesic dome, the US armed forces, NASA and other organizations are displaying an impressive array of pictures, models and actual hardware which indelibly underline America's solid achievements in space. The visitor first encounters an exhibit aimed at selling the idea of M3 airliners, numerous suggested configurations being superimposed on a world map with M3 travel times ("air times only") given for all major routes. There follow such attractions as: Tiros, the weather satellite; Dyna-Soar; space capsules, carried in many Thor and Atlas missiles to provide basic data; the actual Discoverer 14 capsule, snatched in mid-air last August 19; nuclear ramjet development (see Tory—page 744); SNAP nuclear power generators 1A, 2, 3 and 4; Excelsior balloon-jumps for bio-physical research; protective and environmental clothing; boost-glide vehicles; a complete Discoverer spacecraft; extensive displays of microelectronics, molecular electronics, hi-temp components (1,000hr at 500°C seems to be the usual design figure), the National Company's atomic (cesium-ion) clock, which measures time to within 1sec in 1,271 years for many space purposes; models of large boosters; advanced propulsion systems; and Cdr Shepard's Mercury capsule.

Missiles and Spaceflight

The first launch of a Minuteman, on February 1, could hardly have been more successful; but the second, on May 19, ended in destruction by the range safety officer after about 90sec. As seen here, the lift-off was satisfactory, but the new ICBM departed from its trajectory after second-stage ignition

AMERICAN ON THE MOON IN 1970

In a prepared address read before both Houses of Congress in Washington on May 25, President Kennedy openly committed his nation to an all-out race with the Soviet Union in the entire field of space research. In particular, he said, "I believe this nation should commit itself to achieving the goal, before the decade is out, of landing a man on the Moon and returning him safely to Earth. No single space project will be more exciting, or more impressive, or more important for the long-run exploration of space. And none will be so difficult or expensive to accomplish."

He called for Congress to approve additional space expenditure of from $7,000m to $9,000m during the coming five years, and he specifically asked for an immediate injection of a supplementary $1,400m for the 1962 fiscal year to cover a variety of space, defence and foreign-aid programmes. Out of this sum, $531m is for the Man-on-the-Moon programme, $144.5m is allocated to large boosters (including the first vote for Nova airframes), $130.5m is to be injected into the Apollo programme for a three-man spacecraft for Earth orbit and Lunar landing, an additional $23m is earmarked for the Rover nuclear rocket, $50m will speed the development of communications satellites and an extra $75m is requested to accelerate "a satellite system of world-wide weather observation." In perspective, the President's proposals will result in the original fiscal 1962 NASA budget being increased from $1,109,630,000 to $1,784,300,000 (an increase of 61 per cent).

On the same day, Mr James E. Webb, administrator of NASA, outlined some of the accomplishments which the increased financing should make possible. The plan for soft Lunar landings of instruments (Surveyor, followed by Prospector) is being brought forward, so that "during 1963 at the latest" Lunar data and samples of the Moon's surface should have been returned to Earth. Earth orbit by manned Apollos should be possible in the calendar year 1964, following which an Apollo with its complete three-man crew will be sent into Lunar orbit to survey possible landing areas. "Finally during 1967, if all goes well, but by 1969 at the latest, the landing of men on the Moon will take place. The journey is expected to take about five days. The men will stay on the moon for a few days and then make the return trip, which will also take about five days."

EUROPEAN SPACE INDUSTRY

Potentially the most significant meeting held during the Paris Salon (pages 734-743) was that on May 28 of representatives of most of the major industrial groups interested in forming a Western European industrial aero-space union. This international group is an entirely new concept, for it is to be completely comprehensive and embraces all the members of the other consortiums already established. Limited objectives were aimed at on May 28, but the ground was laid for further discussions. It is also pertinent to note that, although there was no official communique, it is clear that the meetings between the British and German Ministers of Defence and the British Minister of Aviation have ironed out most of the major difficulties attendant upon the Government-sponsored European space programme based upon Blue Streak. A favourable German decision at an early date has been widely forecast.

OUTSTANDING VIGILANT PERFORMANCE

Although, doubtless for reasons of timing, the Vickers-Armstrongs V.897 Vigilant has failed to win an inventory contract from the US Army—who chose Entac, as reported on May 18—the British weapon has given further proof of its technical superiority in the field of infantry anti-tank missiles. British Aircraft Corporation announced on May 24 that, at a demonstration before NATO officers "somewhere in Europe," 11 direct hits were scored against moving tanks with 13 rounds.

The announcement said that the show was specially designed to prove that an infantryman with the missile could knock out tanks single-handed at ranges from nearly a mile down to 200yd. For nearly all the shots the tank was behind a ridge, and showing only half of its small gun-turret. Twice the turret was showing for only 20sec. Although the missiles were not fitted with live warheads, the tank was "quite badly damaged." After 12 missiles had been fired, the senior general asked the Corporation's missile trials team to engage a tank at 200yd while it was travelling at more than 20 m.p.h. "This most testing shot of all resulted in a hit on the inside of the tracks of the tank just underneath the turret."

SEACAT POTENTIOMETER

Short Bros & Harland Ltd can now reveal brief details of the metal-film potentiometer which they have developed as part of a cordite-driven gyro for the Seacat close-range ship-to-air missile.

Owing to the extreme miniaturization demanded in the application, it was considered that no normal wire-wound potentiometer could fulfil the design task, and the company's Precision Engineering Division at Castlereagh developed a method of replacing the wire by a film of metal less than 0.000001in thick.

Deposition of the metal is accomplished by heating a small piece of it—usually a Ni-Cr alloy—to about 2,500°C under extreme vacuum conditions. The metal vaporizes, and condenses evenly on all unmasked portions of the high-temperature ceramic used as a former. Means have been found for making the deposited film very regular and free from all variation in thickness. The wiper arm thus makes a perfect contact at every point—a factor of great value in applications where it is desirable for wiper travels of the order of 0·001in to be detected.

This deposition process is to be employed under licence by Miniature Electronic Components Ltd, of Woking, Surrey, who during their 18 months' existence have made a speciality of subminiaturization. Among their other products are a range of potentiometers and resistors made under licence from three US firms, and their customers include "all leading" British manufacturers of missiles and aircraft electronics, and the computer industry.

A Titan ICBM made a full-range flight down the Atlantic Missile Range before dawn on May 24.

Certificates of honour for exemplary work in the observation of satellites have been awarded by the Astronomical Council of the Soviet Academy of Sciences to a group of students and scientists of Uzhgorod State University.

The first flight Saturn SA-1 vehicle is ready for static firings at the Marshall Space Flight Center at Huntsville, Alabama. It is hoped to complete a full-tanks run at 1,320,000lb thrust for 125sec, and many functional tests, before shipment by barge to the Cape.

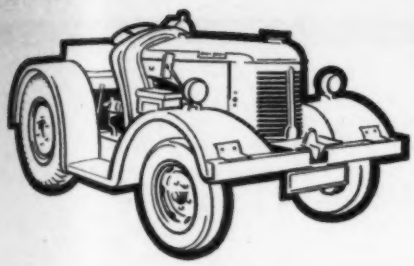
Prof Sir Bernard Lovell, OBE, FRS, Professor of Radio Astronomy at the University of Manchester and director of the Nuffield Radio Astronomy Laboratories at Jodrell Bank, has accepted the appointment of scientific advisor to the British Space Development Co Ltd.

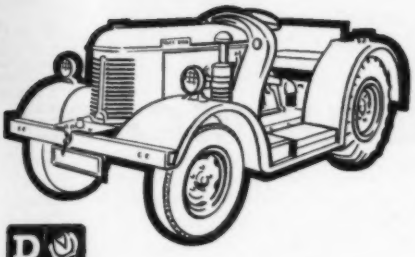
In a lead-story with a Paris date-line, the *Sunday Telegraph* of May 21 forecast the appointment of an RAF director of requirements for space projects. It was claimed that the RAF is formulating requirements for navigation and communications satellites, satellite interrogation and satellite destruction by ground-based weapons.

Convair's improved Model E Atlas achieved its second success in seven launchings on the night of May 12. A 5,000-mile flight was made down the Atlantic Missile Range, a 30lb data capsule being retrieved from the ocean near Ascension Island about an hour after impact. This is about 60 per cent of the ultimate range with full payload.

Tory II A-1, the nuclear reactor intended for research into possible nuclear ramjet propulsion systems, was successfully operated for the first time on May 14. A power of 40MW thermal was held for 45sec, at a core temperature of about 2,000°F. Later testing will steadily increase the power, until the design power of 150MW is attained. The applications of the eventual engine are primarily atmospheric, rather than concerned with space.

Speaking in the French National Assembly on May 4, M. Guillaumat, Minister for Public Functions, suggested that a first possibility for a joint European space programme could be a heavy Earth satellite equipped with instruments for astronomical observation. A second project, which should be feasible within the next seven years, would be to equip a heavy lunar satellite to be launched by a powerful rocket not yet available, after which an automatic observatory might be sent to the Moon.





like the albatross

...the modern aircraft, a picture of power and grace when in flight, becomes awkward and unmanoeuvrable on the ground. Fortunately there's usually a David Brown tractor on hand to tow the earthbound giant wherever it may be needed. David Brown machines are used at most of the major airports to ensure rapid ground movement and control of aircraft.

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Missiles and Spaceflight . . .

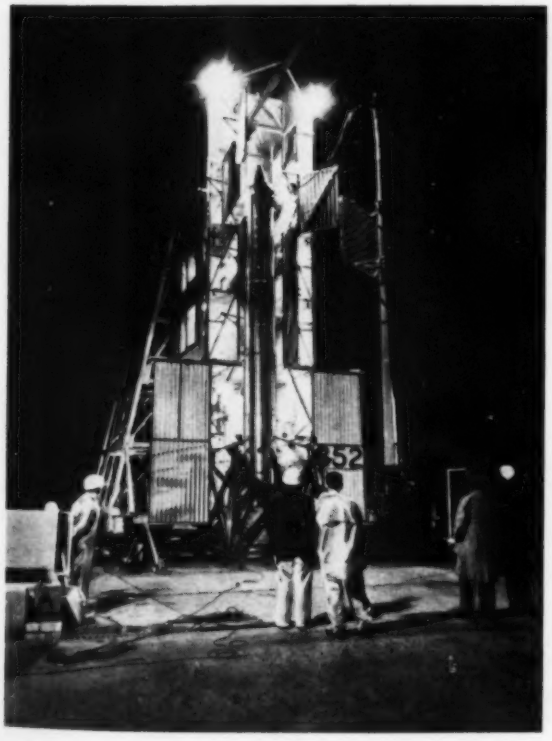
FIVE YEARS WITH HTP

By E. G. D. ANDREWS
Chief Designer, Rockets,
Bristol Siddeley Engines Ltd

This week Bristol Siddeley have a Stentor rocket engine on show at the Paris Salon. Stentors are pictured on the right in final assembly at the company's Coventry factory

THE Rocket Department of Bristol Siddeley Engines began to study rocket engines in 1946, when it was part of Armstrong Siddeley Motors in Coventry. By 1948 the programme of basic development was well advanced which led to the flights of the Snarler in the Hawker P.1072 in 1950 and 1951. Development of the Screamer, described in *Flight* for July 27, 1956, followed almost immediately; this engine was originally intended for the main propulsion of the Avro 720 intercepter, but was cancelled at the end of 1955 on completion of its flight clearance test. The cancellation was to us a disappointment, because it marked the close of an era of experience with liquid oxygen used in conjunction with kerosine as a rocket propellant.

Immediately, however, contracts were won for two new rocket engines, both larger than the Screamer, but both using hydrogen peroxide (HTP) instead of liquid oxygen. Of these, one culminated in the Gamma Mk 201 and the other in the Stentor, some details of which have now been released. Alone of British rocket-engine manufacturers, Bristol Siddeley thus have a close association with both liquid oxygen and hydrogen peroxide, and it is interesting to compare the design of these two recent engines in the light of this experience.



There is no perfect oxidant for rocket engines. From considerations of performance alone, the most attractive are fluorine, oxygen and others consisting entirely of light elements which will combine exothermally with a fuel; these are mainly cryogenic. Less energetic, but liquid, oxidants are also used: in these, reagent elements are combined with elements which do not react, or are already saturated, and which merely dilute the gaseous combustion products. Hydrogen peroxide represents an extreme example, because less than half of the oxygen present is available for combustion. Thus 85 per cent HTP decomposes into a gaseous mixture which contains only 40 per cent free oxygen by mass, the remainder being steam. It qualifies as a rocket propellant only because heat is released during its decomposition—sufficient, in fact, to raise the decomposition products to a temperature of 900°K. In both the Gamma and the Stentor, kerosine is then burnt in these decomposition products.

At the very high temperatures encountered in the combustion of rocket propellants, the products are not completely reacted. Thus, in addition to carbon dioxide and steam, carbon monoxide and free oxygen may also be present, along with many unstable radicals. This tendency for the combustion products to dissociate increases as the temperature is raised: at 2,000°K there is little dissociation, but at 2,700°K approximately one-tenth of the available energy is lost through incomplete reaction, while at 3,400°K nearly a third of the energy is lost in this way. During the expansion process it is possible that some of this heat may be regained by reassociation, but the benefit is not usually very striking.

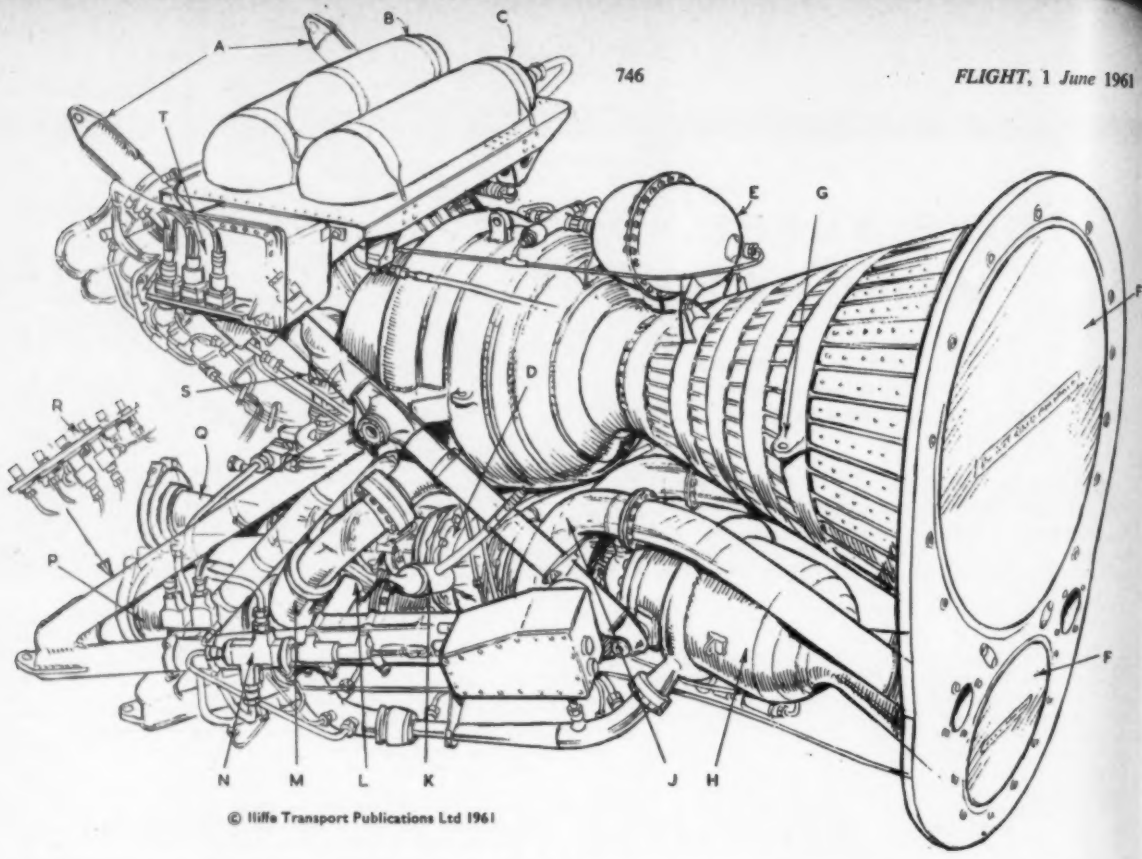
The heat of reaction of HTP with kerosine is only two-thirds of that of liquid oxygen with kerosine. However, because the combustion temperature of the former is 2,700°K, compared with 3,400°K for liquid oxygen/kerosine, the useful energy is only about one-fifth less, corresponding to a difference in specific impulse of only one-tenth. There is also a greater amount of carbon dioxide in the combustion products of liquid oxygen and kerosine, which tends to increase the mean molecular weight of the exhaust gases and hence to reduce the specific impulse. Of course, if the fuel is hydrogen, this does not apply, and liquid oxygen then shows up to greater advantage.

As an indication of merit, specific impulse is relevant to vehicles with lifting surfaces. Here, thrust is mainly required to overcome aerodynamic drag, and the range of the vehicle is a function of burning time. This type of vehicle can weigh more than the thrust, and a propellant load one-tenth greater than that required for a liquid oxygen/kerosine engine may be acceptable in order to gain the advantage of having a storable oxidant like HTP. As this seems to have been one of the arguments which resulted in the cancellation of the Avro 720 it is worth considering in detail.

A bucket of liquid oxygen will evaporate in about an hour. In bulk storage in large quantities it is possible to provide sufficient insulation to keep evaporation to a few per cent per year, but in the size of tank required for a fighter, with 2in of foamed plastic for lagging, the evaporation rate might be 2 per cent per hour.

[*Continued overleaf*

An exceptional record of reliability has been established by the Black Knight research vehicle, one of which is portrayed at left on its pad at Woomera. Powerplant is a Bristol Siddeley Gamma Mk 201



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Bristol Siddeley's latest rocket engine of which details may be disclosed is the Stentor, now in production as the powerplant of the Avro Blue Steel air-to-surface missile. Performance figures may not be divulged, but this "Flight" copyright drawing clearly illustrates its layout. A, main thrust frame and attachments to airframe; B, N_2 cylinder for engine control system; C, N_2 cylinders for purging; D, turbopump gearbox; E, oil reservoir; F, blanking covers, bearing legend "do not remove for flight"; G, datum lugs; H, auxiliary combustion chamber; J, turbine and exhaust pipe; K, small steam generator; L, small HTP pump; M, large HTP pump; N, throttle valve and Avro actuator; P, large HTP suction valve; Q, small HTP suction valve; R, telemetry connections; S, large fuel stop-valve; T, electrical connections and junction box

Missiles and Spaceflight . . .

If the vehicle is required to stand in readiness for long periods, it must obviously be topped up fairly frequently; this can be made automatic, but it is a complication. The weight of any lagging provided also tends to offset the performance advantages of liquid oxygen.

HTP, on the other hand, has a boiling point higher than that of water, and a freezing point sufficiently low to render heating unnecessary except in Arctic conditions. (Heating may be desirable, however, in cold weather to permit rapid starts if these are required.) It is not quite chemically stable, and decomposes slowly but spontaneously during storage; but if it is placed in a suitably prepared tank this decomposition can be neglected for periods of a month or two.

For ballistic missiles, evaporation is not important if the launch time can be selected in advance, and liquid oxygen may be used in unlagged tanks. The performance of a ballistic missile, moreover, is more nearly proportional to its energy, i.e., to the square of the velocity attained. As that velocity is directly proportional to the velocity of the exhaust gases, it follows that the square of the specific impulse is a better indication of merit. For vehicles of this type, therefore, the use of liquid oxygen results in an advantage over HTP of about 25 per cent.

In this connection, it is noteworthy that it is not the altitude attained by the Black Knight ballistic vehicle which is significant, but its re-entry velocity. The performance penalty paid for using HTP instead of liquid oxygen is therefore only one-tenth in this application. The most important consideration in the choice for Black Knight was the existence of a number of rocket-engine components using the propellants discussed here. They had been designed by the Rocket Propulsion Establishment at Westcott for research purposes, and the whole design of the vehicle was based on them.

The existence of these components was valuable to Bristol Siddeley in starting work on a new oxidant. The contract called for their redesign and development to make them suitable for the new application; this task was tackled with vigour, and the first engine was delivered to Saunders-Roe Ltd within two years of receipt of the contract. The first launch at the end of 1958 was an encouraging success.

After many years of work on liquid oxygen, the simplicity of an HTP/kerosine engine seemed remarkable. The gas-generator, which had been a major development problem on the Screamer, was reduced to a simple uncooled container enclosing a catalyst pack. Gone were the electrical ignition systems; and the system interlocks were reduced to the absolute minimum—one per combustion chamber. Admittedly, the development of the catalyst packs was a fresh art, but much valuable basic work on these had already been carried out at the RPE. Only later were we to find that new problems were introduced by inexplicable variations in the catalyst-pack performance, and that HTP as a coolant had a few unattractive characteristics. Nevertheless, since the first flight, the Gamma engine has continued to be successful without any major design changes. A simplified presentation of the Gamma system is shown at the top of page 747.

(Continued on page 747

PROPERTIES OF ROCKET PROPELLANTS

Propellant	$\frac{O}{F}$	T_c (°K)	$\mathfrak{M}$	γ	$\left(\frac{lbsec}{lb}\right)$	sp. g.
85% hydrogen peroxide (HTP)	—	900	21.9	1.28	132	1.37
Isopropyl Nitrate (IPN)	—	1295	21.0	1.22	175	1.04
78% HNO_3: 22% NO_2/kerosine	4.1	3120	25	1.23	238	1.30
85% HNO_3: 15% NO_2/hydrazine	1.3	3020	20	1.25	257	1.26
85% HTP/kerosine	8.0	2790	21	1.18	240	1.27
100% HTP/hydrazine	1.7	2860	19	1.22	263	1.24
Nitrogen tetroxide/kerosine	3.0	2390	—	—	229	1.19
Nitrogen tetroxide/hydrazine	1.1	3010	19	1.26	255	1.20
Liquid oxygen/kerosine	2.3	3520	22	1.24	263	0.98
Liquid oxygen/hydrazine	0.75	3240	18	1.25	280	1.06
Liquid oxygen/liquid hydrogen	3.5	2760	9	1.26	363	0.26
Liquid fluorine/liquid hydrogen	4.5	3035	8.9	1.33	375	0.32

Specific impulse based on sea-level chamber performance at 500lb/sq in

DART
Herald

Pressurised civil or military jet-prop transports; 56 passengers or 6½ tons of freight or combinations of both at 275 m.p.h. for 850 miles; operates from 1000-yd. grass airstrips; built for long life and easy maintenance; penny-a-passenger-mile economy.

D

. . . a Herald cut one engine— and climbed another 500 feet

From Port Moresby in Papua a Dart Herald was flying at 12,500 feet on a proving flight—part of its tough see-it-in-action testing programme which has taken aircraft of this type nearly 200,000 miles around the world to 56 widely-differing countries.

A local airman challenged the Herald's pilot to cut an engine at that altitude. He did so and climbed another 500 feet for good measure—as proof of the Herald's capability on half its power.

Heralds are built by Handley Page to fly; to fly strongly and safely with power to spare. They are making light work of some of the most difficult flying conditions and airstrips anywhere.

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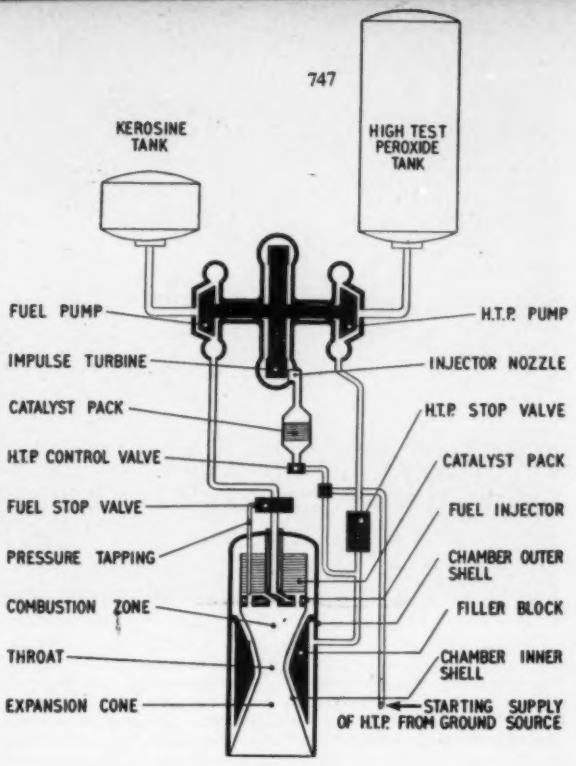


Prepared by Bristol Siddeley, this diagram illustrates in schematic form the basic layout of an HTP/kerosine engine suitable for a ballistic vehicle. The diagram is broadly representative of the Bristol Siddeley Gamma, although only one thrust chamber is shown

Within a few months of beginning work on the Gamma engine, Bristol Siddeley began development of the Stentor engine for the propulsion of the Avro Blue Steel stand-off bomb. This used the same propellants, and much Gamma experience was embodied in it. It had two combustion chambers, one small one and the other four times as large. Unlike those of the Gamma engine, the shells of the combustion chambers were made from tubes. In the large chamber the tubes were fabricated by welding together nesting channels; in the small chamber the tubes were pressed to shape from round tubes by a patented process. Both shells were reinforced by bands to withstand the hoop stresses. Because each tube is self-supporting, the compressive hoop stress imposed on the inner shell of the Gamma combustion chamber is eliminated by this construction, and the internal profile is more stable.

Unlike the Gamma engine, but like the Screamer, the Stentor propellant pumps are separated from the turbine by a reduction gear. This enables the pumps to be driven at speeds suitable for the suction pressures, which are lower than those for the Gamma. The propellant flow to the steam-generator is controlled by a throttle valve to give control of thrust by variation of turbine speed, and hence of pump delivery pressure. It was found that initial decomposition of HTP provided conditions in which good performance could be obtained at low thrusts (with liquid oxygen and kerosine, throttling resulted in a greater loss of performance).

The advantage of HTP engines in functional simplicity is offset to some extent by necessity for a greater amount of preparatory work during manufacture. All surfaces that are to be in contact with HTP must be "passivated" to prevent surface decomposition, and all pipes and valves must be drained and dried out to prevent corrosion products from being formed. Quite a number of the pipes on the Stentor engine are provided for this purpose. Neither of these requirements exists if liquid oxygen is used.

About fire hazards, it is difficult to draw comparisons. It is probably true to say that fires with liquid oxygen are less easily started, partly because combustion with oxygen gas is not spontaneous, and partly because liquid oxygen is so cold; but once they are ignited they are more fierce. Fires with HTP can start spontaneously if the fluid comes into contact with combustible material, though there has been one case in which, it is believed, HTP actually extinguished an existing fire. No comparable case with liquid oxygen is known. However, from the point of view of general handling, liquid oxygen seems to be rather more docile, because any spillage rapidly evaporates and diffuses. The only protective clothing necessary is a pair of asbestos gloves, whereas with HTP complete coverage by protective suits is essential.

In general, therefore, engines burning liquid oxygen with kerosine are rather more difficult to develop than engines burning HTP with kerosine, but have a higher performance. For many applications, the logistical advantages of HTP more than offset the lower performance, but for ballistic missiles this may not always be the case, depending on the application. Reliable engines can be made to burn either oxidant, and the choice depends on the relative advantages of performance and convenience.

I wish to acknowledge indebtedness to Bristol Siddeley Engines Ltd, for permission to publish this article. The views expressed are, however, my own.

MORE DYNA-SOAR SUB-CONTRACTS

During May the Boeing Company announced several major sub-contracts awarded for essential elements of the Dyna-Soar manned space glider. A lengthy news-item on Dyna-Soar was published in our May 18 issue. The following sub-contracts are listed in the chronological order in which they were awarded.

Nosecap Chance-Vought's astronautics division have received the contract for this essential component, which will be made of "ultra-high-temperature ceramic material."

Flight-control electronics The "electronic equipment necessary to achieve control through the use of automatic or manned commands" is the task of Minneapolis-Honeywell Regulator Co.

Tunnel Programme Dyna-Soar tunnel testing will far surpass any comparable programme in the history of flight. From early 1958 numerous models and tunnels have been brought into play, and the major part of the work is concentrated at Boeing, Avco, Cornell Lab, GE, Martin, University of Washington, Ohio State University, University of Southern California, Arnold Engineering Development Center (USAF), JPL and the Ames and Langley Research Centers of NASA.

Landing gear According to Boeing, the main landing-gear skids "will look like wire brushes mounted on skis." Goodyear Tire and Rubber is charged with the design and development of these units; no brakes will be fitted, the wire-brush arrangement being designed to have high ground friction. Bendix have been assigned the task of developing the retractable nose gear, which "will resemble a shallow kitchen dish-pan. The gear will be suspended from the underside of the craft like an inverted toadstool."

Test instrumentation A contract worth several million dollars has been signed with Electro-Mechanical Research Inc for the test instrumentation subsystem. It will include an airborne pulse-code modulated and frequency-modulated conversion system, a time-coded generator and a tape recorder for storing data. The contract also includes ground equipment for receiving, displaying, recording and processing the data. The communications and data-link sub-contract was earlier awarded to RCA.

Acceleration rocket A multi-million dollar sub-contract for this unit was on May 16 awarded to the Elkton, Maryland, Division of Thiokol Chemical Corp. The complete motor will consist of a case, thrust-vectoring system, solid propellant and ignition system, and it will perform the dual functions of providing additional boost propulsion and emergency escape from the booster following a serious malfunction on the pad.

Reaction-control power Thompson Ramo Wooldridge's Tapco Group in Cleveland have been awarded the sub-contract for the "power component" of the reaction-control system, for providing stability and control at all times when the conventional aerodynamic controls are not completely effective. Control forces will be imparted by hot-gas jets from miniature rocket nozzles at the extremities of the craft, fed from a central gas-generator in which is burnt liquid oxygen and liquid hydrogen. The sub-contract for this generator was previously awarded to Westinghouse Electric.

ACADEMY OF ASTRONAUTICS

RECENTLY elected members of the International Academy of Astronautics include Prof David R. Bates of Queen's University, Belfast; Prof Sydney Chapman, High Altitude Observatory, Boulder, Colorado; Dr M. J. Lighthill, Director of RAE, Farnborough; Air Cdre W. K. Stewart, RAF Institute of Aviation Medicine, and Sir Harold Whittingham, Chief Medical Officer of BOAC. The Academy's first honorary member is Niels Bohr, the Danish physicist. The academy, which now has 76 members from 18 countries, was set up by the International Astronautical Federation at Stockholm in August 1960 for the purpose of "promoting the advancement of astronautical sciences." The Academy is working under a grant from the Daniel and Florence Guggenheim Foundation of the USA, and the French Government has provided secretariat offices in Paris.

FIRST DOUBLE ATLANTIC CROSSING

The Story of R 34's Remarkable Voyage in 1919

BY W. E. CASLEY

NEARLY 42 years ago, on the morning of July 2, 1919, the R 34 was manhandled out of her shed at East Fortune, near Edinburgh, to attempt the most adventurous Atlantic crossing since Columbus. At 0142hr the bugle call for "Hands let go" was sounded and the airship left the ground to disappear almost at once into low cloud at 100ft.

R 34, commanded by Maj G. H. Scott, AFC, had been built at Inchinnan, near Glasgow, by William Beardmore & Co. of Dalmuir. She was 640ft long and nearly 100ft from the keel to the top of the bag. She had five 275 h.p. Sunbeam Maori engines, one to each of the forward and two wing cars and two in the after car. Her maximum speed was about 45kt but it was customary to cruise with only three, or even two, engines running at any one time. On the two wing and after engines she could manage between 38kt and 42kt, burning a total of 52gal of petrol an hour. On the two wing engines only she gave 30kt. for a consumption of 25gal/hr.

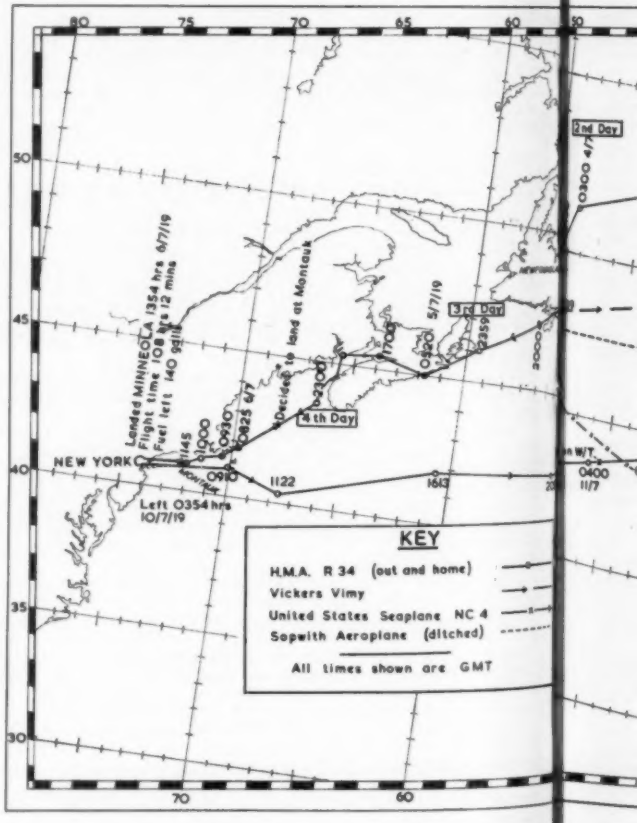
For this particular flight all her 70 petrol tanks, of 70gal each, were full. To the 4,900gal of fuel were added 230gal of oil, three tons of water ballast and 80gal of drinking water. Crew, food, bedding and spares brought the total load up to 24.32 tons. For the crew of 30 there was only cold food. Apart from an arrangement for boiling water on an exhaust pipe there were no cooking facilities and they had to make do with cooked beef, stew, ham, meat pies, cooked potatoes, hard-boiled eggs, bread, jam, margarine and cheese, supplemented by toffee, chocolate, cake and Oxo.

After take-off the ship made her way across Scotland at the very low altitude of 1,500ft, threading her way through the Firth of Forth and the Clyde Canal to avoid hills rising to the 3,000ft mark. She came abeam Glasgow at 0250hr and ran into such violent bumps that at one time the nose was up 24°. By 0445 she was off the north coast of Ireland with nothing but the Atlantic ahead between herself and the chosen destination of New York. Half an hour later she was in thick fog.

All navigation was to be done by a combination of dead reckoning, direction-finding wireless and an ordinary sextant, using sun to cloud horizons. The navigator was of the opinion that he could get to within 40 miles of his target by his sextant; but he voiced the hope that someone, someday soon, would develop a bubble sextant which would enable him to cut this to ten miles.

The original meteorological forecast had given a depression centred over the southern half of the North Sea and a later one, received in flight, offered another depression coming up from the south into the Atlantic. Maj Scott then planned deliberately to fly north of this depression in order to take advantage of the fact that in the northern hemisphere winds blow anti-clockwise around an area of low pressure. This, surely, must have been the first recorded attempt at pressure-pattern flying.

At 1400hr the fog was beginning to thin; and it was about this time that the first of two stowaways was discovered. To cut down load one member of the crew, AC2 W. W. Ballantyne, had been left behind. Being determined to make the trip, he had hidden high up in the ship on a girder running between the gasbags and waited



twelve hours before emerging to give himself up. The second stowaway was discovered a little later in the forepart of the keel—a kitten.

Second Day By 0920 the original ETA of St. John's by midnight that night had to be recast. With 750 n.m. to go it was now put back to 0920 the next day. By noon the captain was having trouble in resolving the true altitude of the ship. A sea-level aneroid, carried for this especial purpose, was lowered to the water, but when pulled up again it gave the same reading as when it had left the ship. A most ingenious trick was then employed. The ship's shadow was almost vertically below; knowing her length to be 640ft, the navigator measured with a sextant the angle subtended by the shadow. From this the true altitude of 2,100ft was calculated —what time the altimeter was showing 1,200ft, an error of 900ft. At 1400hr some copper sheeting and the whole crew's supply of chewing gum was requisitioned to repair a water-jacket on the starboard midships engine. By now the wind was backing and freshening, until by 1800hr the groundspeed was down to 25kt and the angle of drift was 70°.

Third Day Early in the morning efforts were made to raise Cape Race DF station. Cape Race smartly ordered all other ships off the air and concentrated on raising R 34, but it was some hours before contact was satisfactory. By 0840hr they were working well although still 250 n.m. apart. The ship was still plugging into headwinds and it was not until 1700hr (GMT) that land was sighted. It later proved to be the coast of Newfoundland, and it was crossed at 1752, exactly 59hr after leaving Rathlin Island on the north coast of Ireland. Although groundspeed now began to show a little improvement the petrol situation was already causing anxiety. By 1845 the airship was still 870 miles from New York. At 2015 (4.15 p.m. local time) it was over the small town of Fortune, which was marked on the map as having a telegraph station. Messages to the Governor of Newfoundland and others were dropped by a parachute; it failed to open, but the bag was seen to fall in a meadow and local inhabitants picked it up and the messages were duly delivered.

Fourth Day At 0015 Nova Scotia was sighted and the headwinds sprang up again. At 0630 airspeed was 36kt but groundspeed was nil. At 1000 Maj Scott brought the ship down to 600ft to try to break through what was later described as "a wind barrage," and at 1100 he crossed the coast with the idea of finding less wind in the Bay of Fundy. By 1630 the petrol situation was becoming really serious and he was considering three possibilities. They were (a) accept a tow from a destroyer and cast off at dawn, (b) come down to 300ft, ride to a sea anchor and refuel from a destroyer, and (c) land at Boston to refuel. Signals were sent to the US Navy asking for destroyers to stand by.

At 1845 the ship was caught in a violent storm as she entered the Bay of Fundy. During one gust she went straight up for 700ft. This storm continued until 0130 the following morning, and electrical discharges made it impossible to use the radio.

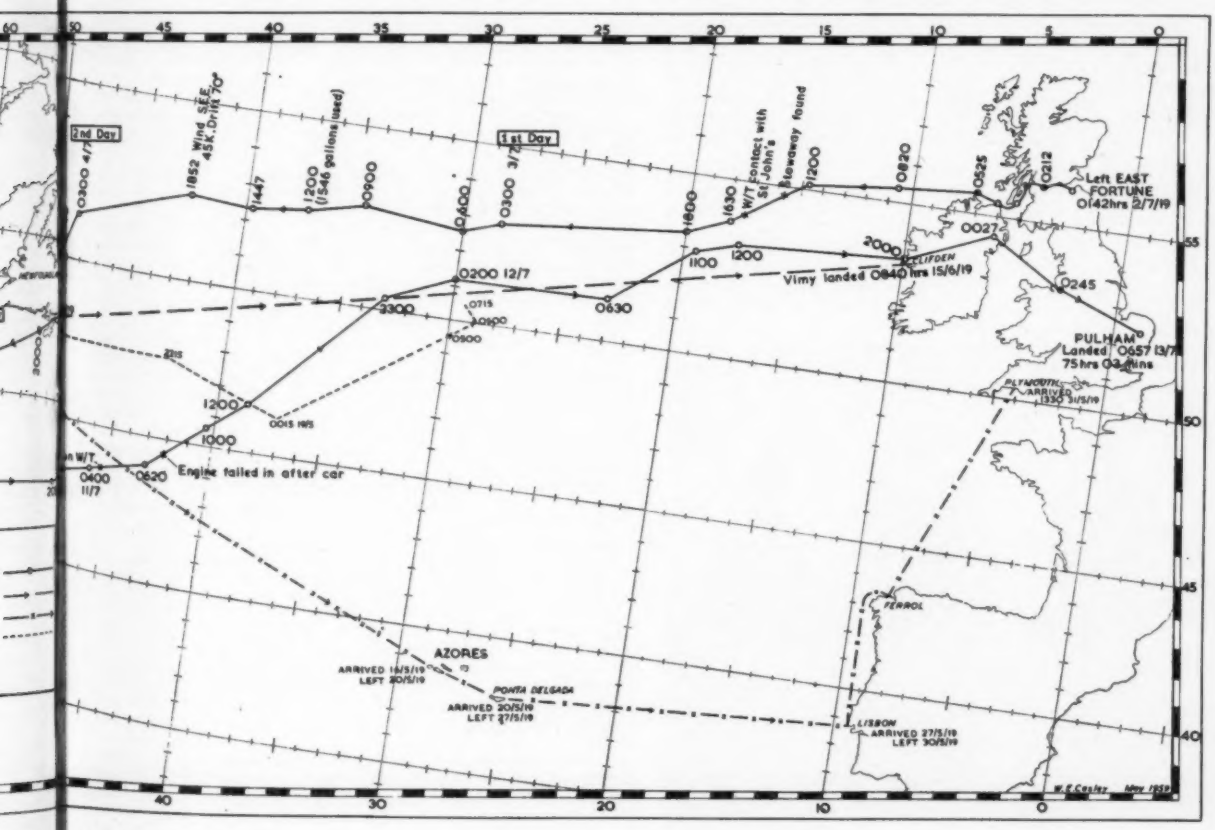
Fifth Day By 0330 it was extremely doubtful if New York could be reached and it was then decided to land at the US Naval Air Station of Montauk on Long Island. This would have been an ignominious ending to such a gallant effort, but it now seemed that fate had relented. The wind dropped, and R 34 was able to make progress again. She passed over Martha's Vineyard at 0930 and reached Montauk at 1120. The decision was now taken to press on to New York, and at 1320 she arrived over Hazelhurst, only to find that the landing party had left for Boston by car when it was thought that she would have to land there. Maj J. E. M. Pritchard, OBE, then volunteered to take the place of the OC landing party and promptly proceeded to do so—by parachute. At 1354 the ship was down and the first airship to cross the Atlantic had done so in an elapsed time of 108hr 12min. Fuel remained for two hours at 45kt.

In New York During their stay in New York the crew were royally entertained and, apparently, had great difficulty in paying for anything. One of two carrier pigeons seemed to feel that anything R 34 was going to do he could do better. The birds had been carried for emergency purposes, but one got loose and was later picked up by a westbound steamer 800 miles out in the Atlantic.

Return Journey The return trip was started at 0354 GMT on July 10, and it was planned to fly the ship over London at the end of the voyage. This would have made a most fitting climax, but unfortunately a mishap damaged the engine in the after car beyond

(*Concluded on page 778*)

R 34's outward and homeward routes and times. Routes of pioneer heavier-than-air crossings are also indicated



THE NATIONAL GLIDING CHAMPIONSHIPS

Young Pilots Reach the Top

BY KENNETH OWEN

Illustrated mainly with "FLIGHT" photographs

Williamson's Olympia 419X over Lasham

THIS country's best-ever gliding championships—this was the unanimous verdict on the ten days at Lasham which ended on Monday, May 22. A record run of good-weather contest days—nine for League 1 and eight for League 2—resulted in some 50,000 cross-country miles being flown. For the pilots, their retrieving crews and the contest officials, it was an exhausting but satisfying meeting.

As listed in *Flight* of May 11, there were 50 competing aircraft in League 1 and 40 in League 2. The flying up to and including Wednesday, May 17, was reported in our issues of May 18 and May 25. The League 1 lead was held from the very first day by Sgt John Williamson of the RAF, flying an Elliotts Olympia 419X.

League 1 returned to the Cornish milk-run on **Thursday, May 18,** with a 191-mile goal race to Perranporth as the day's task. League 2 pilots were set a 65-mile race to Nympsfield. The sparkling weather of two days earlier was not repeated, but seven pilots reached Perranporth. In order of speed, they were Williamson (Olympia 419X, 45.2 m.p.h.), Burton (Skylark 3F, 40.7 m.p.h.), Scott (Olympia 419X, 39.8 m.p.h.), Stephenson (Skylark 3F, 38.8 m.p.h.), Smith (Skylark 3, 35.8 m.p.h.), Mann (Skylark 3F, 33.5 m.p.h.) and Dimock (Skylark 3F, 30 m.p.h.). Only a mile short were Brennig James (Skylark 3F), Anthony Deane-Drummond (Olympia 419) and David Cretney (Skylark 3B).

Jerzy Adamek, one of the two Polish pilots who were flying *hors concours* at Lasham, did well on this day by flying the Surrey Club's Skylark 2 a distance of 186.5 miles to Newlyn East. This was the day's best performance in a standard-class sailplane.

Meanwhile, ten competitors in League 2 had completed the race to Nympsfield. The best speeds were set up by Fielden (Skylark 3, 32.4 m.p.h.), Kerridge (Skylark 3F, 28.2 m.p.h.), Neumann (Skylark 3F, 27.3 m.p.h.) and Davey (Eagle, 25.5 m.p.h.). After handicapping adjustments, the day's leaders on points were Davey, Fielden, Dickson, Russell, Greenway and Kerridge.

The Duke of Edinburgh visited the championships on May 19, and was greeted on arrival by Mr Philip Wills (centre) and Mrs Ann Welch

On overall points the leaders were now:—

		Points
League 1.	1. Williamson (Olympia 419X)	4,980
	2. Burton (Skylark 3F)	4,334
	3. Scott (Olympia 419X)	4,078
	4. Deane-Drummond (Olympia 419)	4,056
	5. Wills (Skylark 3F)	3,945

P. G. Burgess was leading the standard-class entries in his Ka-6, with H. P. Hilditch and C. Wills (Skylark 2B) second and G. Coatesworth (Olympia 401X) third.

		Points
League 2.	1. Kerridge and Purnell (Skylark 3F)	3,618
	2. Bacon and Clarke (Olympia 2B)	3,571
	3. Chandler and Newholme (Olympia 2B)	3,436
	4. Carr and Greenway (Olympia (2B)	3,257
	5. Fielden and Berriman (Skylark 3)	3,109

Unco-operative weather on **Friday, May 19,** provided a sound enough reason for League 1 pilots to be given a rest day. For League 2, after a postponed briefing, free distance was declared.

The Duke of Edinburgh arrived by Whirlwind helicopter to visit the championships during the morning. During his visit Prince Philip, accompanied by his Equerry, Wg Cdr John Severne, spoke with Philip Wills and Ann Welch of the BGA, David Carrow of Lasham Gliding Society and other competing pilots and officials, and called in at the launch point. Reappearing at Lasham for an unexpected second visit that afternoon, the Duke inadvertently increased the local circulation of this magazine as his Whirlwind's rotor-blade downwash hit the *Flight* sales stand outside the briefing tent. Prince Philip made an unscheduled stop for a good-humoured chat with *Flight* salesman Ted Mills. "I suggest you sit on them next time," the Duke advised.

The day's best performance in League 2 was a 39-mile flight to Worthing by Alan Purnell, who, flying on alternate days with David Kerridge in Surrey Gliding Club's Skylark 3F, had notched up a 700-point lead by this time. G. C. Fisher from Nympsfield was second with a 32.5-mile Skylark 2C flight to Ford, and K. A. Aldridge in his Olympia 2B was third with 29.1 miles to Barnham. J. W. Pickles (Olympia 2B) and B. J. Davey (Eagle) landed at Tangmere, 28 miles from Lasham.

Although the top place appeared secure, there was a reshuffling of pilots lower down the list. On total points, the picture was now:—

		Points
League 2.	1. Kerridge and Purnell (Skylark 3F)	4,518
	2. Chandler and Newholme (Olympia 2B)	3,838
	3. Bacon and Clarke (Olympia 2B)	3,778
	4. K. A. Aldridge (Olympia 2B)	3,472
	5. B. J. Davey (Eagle)	3,463

The League 1 task on the opening day of the championships had been a race over a 70-mile triangular course with turning points at Thruxton and Welford, and this was again specified on **Saturday, May 20.** On this occasion, however, the course was to be flown in the reverse direction, with Welford as the first turning point. For League 2, it was to be distance along a line through Bideford, Devon.

"Mainly weak to moderate thermals, but occasionally good near cloudbase" ran the met forecast. Winds were northerly, and there was plenty of strato-cumulus and haze about. Or, as met-man Wallington phrased it later that day, when it was clear that to

League I leaders: from the left, Sgt John Williamson (Olympia 419X), George Burton (Skylark 3F), Philip Wills (Skylark 3F) and Mrs Anne Burns (Skylark 3B), who were placed respectively first, second, third and sixth

complete the triangle would be a slow and difficult task, "Some clear spells, but in general rather messy conditions." The headwind component on the first leg in fact brought over half of the competitors down before or near Welford.

Just after 4 p.m. a sailplane was seen coming in on a nicely judged final glide to Lasham. Having identified it initially as an Olympia 419, the small group of observers at the finishing line were not surprised to realize as it approached that it was the familiar number 86. Once again Williamson was first home and, it transpired later, had made the best speed over the course.

Alan Purnell (left) and David Kerridge of Surrey Gliding Club gained the leading place in League 2, flying a Skylark 3F

Standard-class winner in League I was P. G. Burgess in his German Ka-6 machine

It had been a long haul—"a real sweat" was the pilot's phrase—around the triangle. In the first-leg struggle to Welford, Williamson had never exceeded 2,000ft, and over the Thruxton turning point he had been down to 400ft—"so they must have seen me." His time for the race was 3hr 39min, corresponding to an average speed of 19.2 m.p.h.

Only three other pilots, all in Skylark 3F aircraft, arrived back across the finishing line at Lasham. At 4.15 it was George Burton, who had taken 3hr for the first leg and 4hr 49min overall. At 5.28 it was Philip Wills, after an agonizing 5hr 4min, and at 5.34 it was Anne Burns, who had taken 4hr 25min for the trip but who had been airborne for 2hr before crossing the starting line.

Along the League 2 line to Bideford the maximum distance flown was 67.1 miles by Fielden in his Skylark 3, followed by Greenway (Olympia 2B, 60.7 miles), Davey (Eagle, 59.7 miles), Dorman (Skylark 2, 55.2 miles), and Mackworth-Young (Eagle, 52.9 miles). Overall positions in both leagues were now:—

		Points
League 1.	1. Williamson (Olympia 419X)	5,980
	2. Burton (Skylark 3F)	5,249
	3. Wills (Skylark 3F)	4,848
	4. Deane-Drummond (Olympia 419)	4,717
	5. Burns (Skylark 3B)	4,508

The standard-class lead was retained by Burgess (Ka-6) with Hilditch and C. Wills (Skylark 2B) second and Coatesworth (Olympia 401X) third.

		Points
League 2.	1. Kerridge and Purnell (Skylark 3F)	4,600
	2. Davey (Eagle)	4,055
	3. Carr and Greenway (Olympia 2B)	3,999
	4. Bacon and Clarke (Olympia 2B)	3,959
	5. Perrott and Fisher (Skylark 2C)	3,844

The line through Bideford, not very much the worse for wear after Saturday's League 2 flying, was on **Sunday, May 21,** presented to League 1 pilots for their attention. The 40 pilots in League 2 had 40 agonizing appraisals to make, with pilot-selected goal as the day's task. In this they had to attempt to strike the most profitable balance between caution and over-confidence—the safe goal versus the do-or-die, blaze-of-glory attempt to leap into the lead.

Winds were north-easterly, and moderate thermals were forecast. The weather map showed a large area of strato-cumulus, with some patches of cirrus, and visibility was estimated at 12 n.m., decreasing to eight miles in haze streams.

The Bideford line, when extended beyond the town of Bideford itself, was seen to cut the coast at Hartland Point, on the edge of Bideford Bay and 152.5 miles from Lasham. Although the met forecast was not brilliant, someone should perhaps have anticipated that the pundits would land exactly there. The Point was not lost on pilots Kaye, Burton, Deane-Drummond, Piggott, Bentson, Stone and Stark, who descended on Hartland and each collected

1961 NATIONAL GLIDING CHAMPIONSHIPS: FINAL RESULTS

League 1		
1. J. Williamson	Olympia 419X	7,968
2. G. Burton	Skylark 3F	7,121
3. P. Wills	Skylark 3F	6,772
4. A. Deane-Drummond	Olympia 419	6,597
5. D. Ince	Olympia 419X	5,878
6. Mrs A. Burns	Skylark 3B	5,818
7. A. Stone	Skylark 3F	5,811
8. E. Stark	Skylark 3F	5,705
9. P. Burgess	Ka-6	5,391
10. P. Scott	Olympia 419X	5,292
League 2		
1. D. Kerridge and A. Purnell	Skylark 3F	5,360
2. J. Fielden and P. Berriman	Skylark 3	4,809
3. B. Davey	Eagle	4,795
4. M. Bacon and E. Clarke	Olympia 2B	4,533
5. J. Chandler and K. Newholme	Olympia 2B	4,476
6. V. Carr and H. Greenway	Olympia 2B	4,327
7. K. Aldridge	Olympia 2B	4,055
8. R. Perrott and G. Fisher	Skylark 2C	3,848
9. C. Mackworth-Young and E. Smith	Eagle	3,627
10. L. Alexander and S. Neumann	Skylark 3F	3,572

Polish visitors flying a Skylark 2 "hors concours" in the championships were Jerzy Adamek (left) and Roman Zabiello

NATIONAL GLIDING CHAMPIONSHIPS . . .

1,000 pts, while Williamson and Thomas, a mile short and 500 yards off the line, had to be content with 988 apiece.

The best piece of crystal-balling in League 2 was that of J. Fielden in his Skylark 3, both of whom arrived intact and as premeditated at Dunkeswell, Devon, a distance of 98 miles. Second was Dr Gregg, president of Coventry Gliding Club, with 109 miles to Exeter Airport (not his declared goal) in a Skylark 3B. Flying an Eagle two-seater, E. F. R. Smith achieved 73 miles to Yeovil Airfield, his goal, and the day's third place.

Thirty-three League 2 pilots flew more than the 15-mile minimum scoring distance and, of these, nine landed at their declared goal. Some of the remaining 24 may well have decided to overfly their goals, hoping to gain more from the extra distance than from the goal bonus on the original plan. The leading positions on total points were now:—

		Points
League 1.	1. Williamson (Olympia 419X)	6,968
	2. Burton (Skylark 3F)	6,249
	3. Wills (Skylark 3F)	5,830
	4. Deane-Drummond (Olympia 419)	5,717
	5. Burns (Skylark 3B)	5,238

There was no change in the positions of the standard-class leaders compared with those of the previous day.

		Points
League 2.	1. Kerridge and Purnell (Skylark 3F)	5,360
	2. Fielden and Berriman (Skylark 3)	4,809
	3. Davey (Eagle)	4,795
	4. Bacon and Clarke (Olympia 2B)	4,533
	5. Chandler and Newholme (Olympia 2B)	4,476

At past championships the final day has often been devoted solely to the prizegiving ceremony, preparations for it, and a flying display for the public. No reasonable excuse, apparently, has been overlooked for declaring "no contest" and bringing the championships to an orderly, leisurely close. Not so this year, when the organizers and pilots squeezed every thermal and every mile out of the contest right up to the last minute. Landing reports were still coming in by telephone to the control room as the guest of honour was beginning his short speech before presenting the prizes.

The day was **Monday, May 22,** and the League 1 task was a 66-mile out-and-return race to Upavon, approximately west-northwest from Lasham. For League 2 it was officially a no-contest day, but a special daily prize was to be awarded for the best free-distance flight. Winds were north-easterly, and moderate and occasionally good thermals (with some cloud or thermal streets) were forecast.

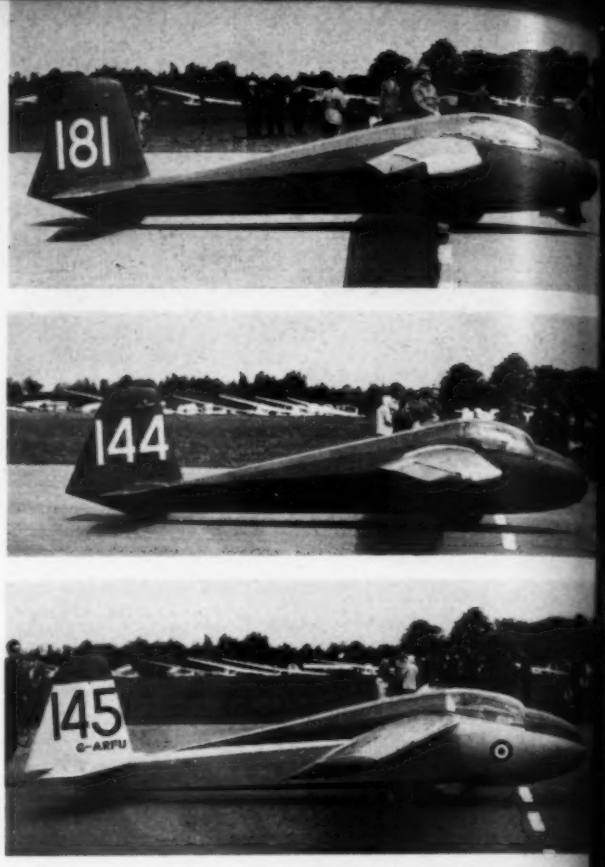
Perhaps it was the incentive of avoiding retrieving journeys on the Whit-Monday roads, or perhaps the soaring conditions really were good. Whatever the reason, sailplanes kept flashing over the finishing line at Lasham with a satisfying regularity. By 3 p.m. 23 had completed the course, and the decision was taken to hold the prizegiving ceremony at 5 p.m.

Again it came as no surprise that one Williamson set up the day's best performance, with an average speed of 36 m.p.h. over the out-and-return course. Runner-up was Philip Wills, closely followed by Derek Piggott, Anthony Deane-Drummond and George Burton. A total of 34 of the 50 pilots completed the League 1 race, while the League 2 free-distance prize was won (at the expense of a damaged wing on landing) by K. A. Aldridge for a 135-mile flight to Great Torrington, Devon.

Prizes were presented by Lord Brabazon, president of the British Gliding Association. Williamson was the new national champion (at the relatively early age of 32); Gerry Burgess had won the standard class with a German Ka-6 machine; League 2 winner was the Surrey Gliding Club partnership of David Kerridge and Alan Purnell; and the highest-placed individual pilot in League 2 was Bernard Davey, an Imperial College member. The Inter-Services Championship was won by the RAF against the Army.

Prizes awarded, the 1961 National Gliding Championships ended with a flourish as a couple of visiting power pilots demonstrated a mock dog-fight. Bill Bedford's Hurricane and Dave Morgan's Spitfire, hot from displays at Hucknall and North Weald, gave a nostalgic sight and sound above the airfield.

Williamson's continuous lead throughout the championships was phenomenal, and would in fact have been even greater had it not been for the introduction this year of the scoring rule which reduced the day's maximum points from 1,000 if less than 60 per cent of the pilots scored. Thus on the first day, when Williamson was the only pilot to complete the Thruxton - Welford triangle, he received only 320 pts. His consistency is shown in the table of day-by-day leading positions at the foot of this page. On the only two days when he was not among the top five, he came sixth (after five pilots who shared first place) and equal eighth (after seven pilots who shared first place).



The first three prototypes of the Elliotts Type 460 all competed at Lasham. From the top, numbers 1, 2 and 3, which were flown respectively by Dunn, Loveland and Gough. Note change in fuselage and canopy contour (first prototype has been modified to the standard of the third)

The outstanding memory of the championships would perhaps be the magnificent Tuesday (May 16), when 39 pilots exceeded 190 miles in flights to the tip of Cornwall. Truly an all-time classic milk-run. A less agreeable memory for many people was the blatant commercialism which intruded far too much in this year's contest, and extended as far as naming a forthcoming type of glider after a particular brand of cigarette.

In operational organization the championships were superb, and task-setting was maintained at the high level for which Mrs Ann Welch has become justly renowed.

It is probably too much to hope that the weather conditions at the next national championships (which may take place next year, since there is to be no World Gliding Championships in 1962) will be up to the 1961 standard. But the overall running of these contests has now reached a high efficiency and, providing certain 1961 extras—such as cigarette commercials broadcast from control vans, control vans which are in fact mobile cigarette advertisements, gliders which are in fact airborne cigarette advertisements, and free-sample smokes for joyride passengers—can be stamped out before the rot spreads further, the gliding movement can look forward to even greater things at Lasham. That is, assuming the object *is* to promote the health of gliding rather than that of the tobacco trade.

This criticism aside, one has only praise for Lasham Gliding Centre's planning and execution of this year's championships. Its members have well earned their security-of-tenure prize.

TOP DAILY PLACINGS IN LEAGUE 1

Day	1	2	3	4	5	6	7	8	9
1.	Williamson	Mann	Stone	Wills	Cretney	Williamson	Williamson	Kaye, Burton	Williamson
2.	Kahn	Deane-Drummond	Bentson	Scott	Williamson	Burton	Burns	Deane-Drummond	Wills
3.	Wills	Stark	Scott = 1	Burton	Scott	Scott	Burton = 1	Piggott	Piggott
4.	Jones	Williamson	Williamson	Deane-Drummond	Wills	Stephenson	Wills	Bentson, Stone and	Deane-Drummond
5.	Burns	Ince	Burton	James	Stephenson	Smith	Ince	Stark	Burton

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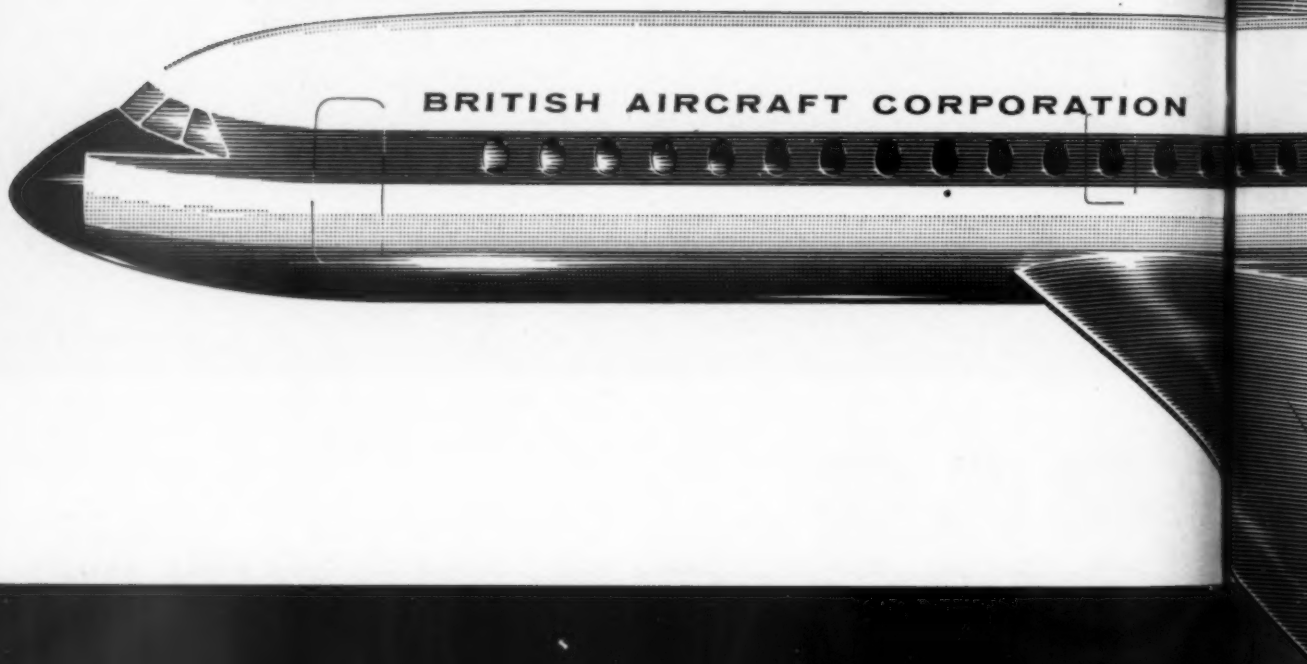

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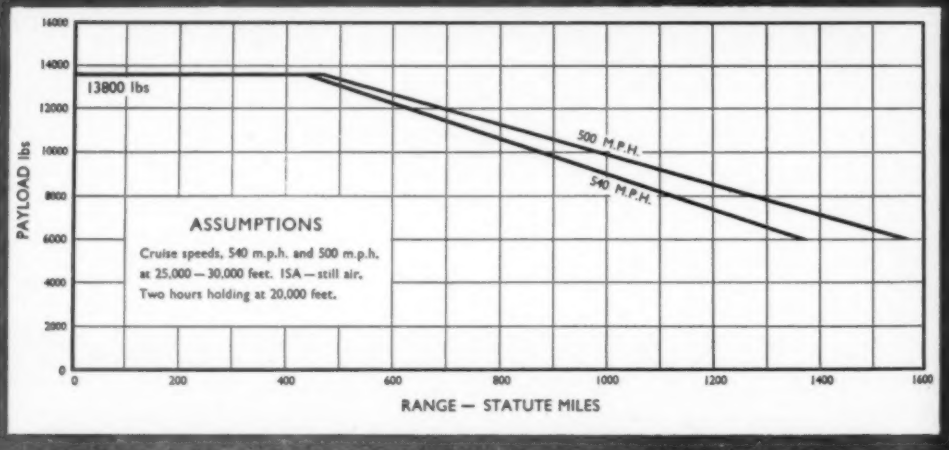
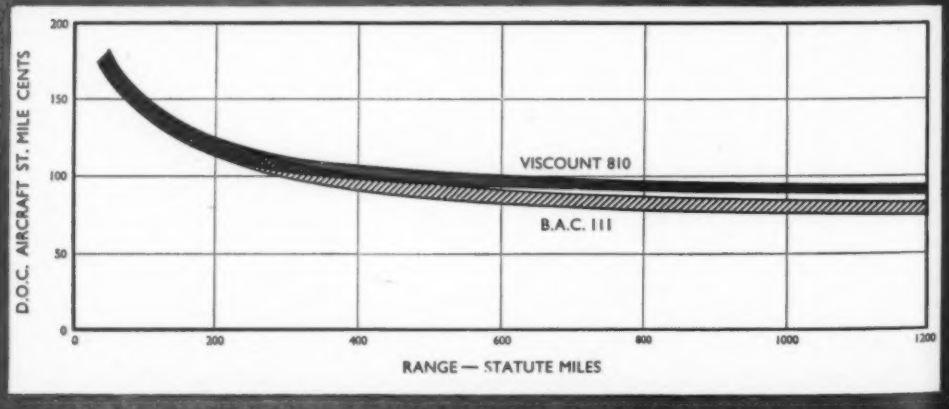


ECONOMICS

These bands cover seven separate methods of costing — ATA (1955), ATA (1960), SBAC and those of four airlines



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COMANCHE ROUND FRANCE

BY MARK LAMBERT

"FLIGHT" PHOTOGRAPHS

The Comanche 250 air-tested by "Flight" in 1959

TWO years ago I made a very rewarding journey in *Flight's* Gemini to visit almost a dozen French aircraft factories at nine different places in six days. Earlier this year I had to repeat the exercise and decided to try something new. I therefore borrowed from the ever-helpful Vigors Aviation Ltd, Piper distributors, Comanche 250 G-ARDL ("Delta Lima") fitted with autopilot, Narco Omnigator and full blind-flying instruments. Petrol and Customs carnets and appropriate aircraft documents were assembled and I went to Kidlington on a Monday to prepare to fly colleague Stuart Cassy and self over to Paris ready to start work next morning.

Through pilot's notes and flight manual I studied the Comanche, mainly in order to learn about cruise control, fuel consumption and payload. The switches and levers in the cockpit were pretty well self-explanatory and I was told that no servicing would be required. Refuelling, checking engine-oil level and handling with the little tow-bar could all be done single-handed and with no more elaborate tool than the nail-file I always carry when flying—and I did them all during the journey without getting my hands dirty. The Comanche and its books are, of course, marked in US gal and m.p.h., but I prefer to operate with Imp gal and nautical miles and I therefore mostly quote these values in this story.

The Comanche carries 50 Imp gal in two tanks and I followed American practice in tilting the aircraft nose-down and seeing that fuel was poured until it overflowed. This ensured that I did not miss the significant few gallons which go in after the level has reached the base of the filler neck. The main question was fuel consumption, because, though none of my journeys would require anything like the four hours' endurance at 75 per cent power that the makers claim, I was most keen to know where I stood in case anything went awry. The Piper handbook says 11.7 Imp gal/hr at 75 per cent power and the Lycoming book says 13.4.

Lycoming tell us not to weaken mixture below 5,000ft, but everyone else says weaken at anything above 1,000ft. In weak mixture, consumption goes down remarkably to about 10 Imp gal/hr. A neat little plastic-covered power chart gives a range of r.p.m. and intake pressure figures for 75, 65 and 55 per cent powers at various heights, together with corrections for deviations from the standard Fahrenheit temperatures listed—actually less than ½in intake pressure for 10° deviation—over a wide range of altitudes.

In planning the actual flights I allowed 5 Imp gal for the maximum of four minutes' warming-up required and for taxying and take-off. I then counted on climbing at 75 per cent power and allowing 3hr 40min at 12 Imp gal/hr. This would give a little under 610 statute miles at the 170 m.p.h. i.a.s. which I established during a test flight—or 148kt and 540 n.m.—in the worst rich-mixture, sea-level case. At the beginning I did not want to flight-plan to achieve better than this.

"Delta Lima" at Toulouse in company with the Breguet 940 STOL prototype. The 940 weighs five times as much as the Comanche but needs only one-seventh of its landing run

The empty weight of Delta Lima was 1,650lb, to which I added 360lb for full fuel and 340lb for self and Stuart, leaving a very healthy 450lb still in hand for oil, baggage and additional people if necessary.

As I got to know the aircraft I discovered that I had a cabin heater which worked very well, separately controlled defrosting air for windscreen and forward side-windows, and no fewer than ten ventilators and a d.v. window to keep me cool even on the ground in stuffy heat. This is the only aircraft I have flown which was tolerable in strong sunlight on the ground. The seats adjusted well and were comfortable. The walkway on the wing was wide enough for me and all my baggage together. The luggage compartment, with its locked door, took everything I tried to stuff into it and all the cockpit switches were clear and simple, with the notable exception of two. The electric turn-and-slip indicator had to be separately switched on. If once forgotten it could prove fatal in poor weather. I have seen similar switches wired in the "on" position. Secondly, the autopilot engaging plunger was right next to and exactly the same shape as one of the ventilator controls. On one occasion I closed what I thought was the ventilator immediately after take-off, but engaged the autopilot and then experienced all the unpleasant symptoms of apparently seized ailerons. The autopilot can be manually overridden.

When engaged and set, the autopilot holds heading on the zero (360°) mark of the d.i. and does it accurately, although it occasionally hunts laterally a little. Only the ailerons are controlled and elevator trim must first be set. One can change heading either by pushing the double control knob and turning it or by caging and rotating the d.i. the desired number of degrees in the appropriate direction. When one is on autopilot only the compass indicates actual magnetic heading, but the aircraft remains sufficiently steady for the compass to be accurately read. The flight manual stated that the autopilot had satisfactorily passed ARB tests for safety in the run-away case. It was not to be engaged during landing or take-off.

The Narco Omnigator, my only radio, had 27 transmitter crystals selected on a rotary switch. With the main selecter set to "Cal," the receiver turning knob was turned until the tuning buzz was at its strongest. Receiver and crystal-controlled transmitter were then synchronized. The selector was next turned to "Com" for voice communications. For VOR, the selector was turned to that setting and the manual tuner then turned until the VOR could be clearly identified aurally by its morse identification, using earphones or the roof-mounted loudspeaker according to the volume setting. There was a separate selector setting and similar tuning for the ILS localizer, but I did not have a chance to try it. The marker-beacon receiver setting did not operate because there was no beacon aerial. The Omnigator was generally poor on communications and earphones had to be used. The receiver scale was at least half a megacycle wrong over the whole band and the left/right needle was over-sensitive; but navigation—even when using a rapid succession of beacons for cross-bearings—was surprisingly effective and I was able to fly without the slightest trouble in visibility which would otherwise have kept me on the ground. One disadvantage was that at the very moment when I wanted VOR to bring me in to an airfield I would have to switch from navigation to communications. Separate VHF communications is desirable.

While these criticisms are valid for the purist, they do not seriously detract from the great value of the Omnigator for the casual pilot. It is an extremely useful device which served me far better than I had expected, and it made a tremendous difference to the whole flight. The Omnigator has a range about half that of a Class 1 VOR receiver, but even that is surprisingly helpful now that VOR coverage in Britain and France is becoming extensive. The

Dramatic view through a rear window from 7,000ft into the lowering sun over the peaks south-west of Issoire

COMANCHE ROUND FRANCE...

ILS and marker beacon can also be used quite effectively for step-down ILS approaches in quite poor weather; but one really must have separate communications for this purpose, unless the particular ILS transmitter has a voice facility and the tower is prepared to use it.

Now for the flight itself. The figures are set out in the accompanying table but they must be read in conjunction with this account if some apparent anomalies are to be explained.

Kidlington to Gatwick (*70 n.m. along track*) We had intended to clear Customs at Lympne, but take-off weather was 200ft, one mile, raining—and Lympne was right in it. After some hours a telephone call to Gatwick showed them to have 700ft and several miles, so we asked for and got permission to clear Customs there.

Took off into the murk and followed the Thames slowly southwards past Abingdon at 120 m.p.h. Tuned Greenham Common VOR, ready to go through cloud and let down on a radial into the clear west of Gatwick, but ceiling steadily lifted and we had 700ft going through the Reading gap. By Gatwick we had almost 900ft, now working on London VOR. Gatwick cleared us for a visual circuit and gave us Stand 14 at the main passenger finger. They could not have been more helpful or quick in clearing us and taking our VFR flight plan for Paris Toussus. We were refuelled, fully cleared and had bought sandwich lunches in 35min flat—the fastest I have ever known except when I once cleared through Lympne during the ten minutes before closing time. Incidentally, we were charged no landing fee, because we only landed to clear Customs. Track distance to Gatwick was about 70 n.m., covered in 45min at 94kt, at low level and reduced power because of poor weather.

Gatwick to Toussus (*183 n.m. along track*) Morale and weather slowly improving. Cleared to turn left on take-off and leave Gatwick zone to the south. Very bumpy air and lowish ceiling, so planned to go east and use Lydd VOR for the crossing, expecting Pope VOR near Paris. Still little idea of Omnigator performance and range, but puzzled to find that it will not receive Lydd; then remember Lydd is out for monthly servicing. Tune Dover VOR. At 1,000ft over Battle, we get Dover strength five—a range of 45 n.m.

Cloud lifts and we climb to 4,500ft, crossing the coast over Hastings on a heading of 120° and intending to fly to the 190° From radial of Dover and then follow that radial down to the Somme estuary. Autopilot now engaged and air smooth; seats pushed back, maps spread comfortably, cabin heat adjusted; eating sandwiches, waiting for the French coast to come into view. This is the life! A standard of comfort I had hardly dreamed of. The clock with two sets of hands is checking elapsed and actual time.

The French coast comes into view and we identify the estuaries one after the other, turning by autopilot to follow the 190° From radial from Dover. At 56 n.m. Dover is still firm, but at 70 n.m. at 4,800ft, the needle becomes sloppy. The To/From indicator is still firmly showing From. We are indicating 168 m.p.h. at 2,300 r.p.m. and 23in, weakened very slightly. Tune Pope VOR, get a strong signal at 70 n.m. and follow the 180° To radial, still on autopilot. For some minutes we are off my maps and do not pin-point position again until we are some 30 n.m. to the south, but the VOR is good and we do not worry.

In sight of the Seine I cry "stand by to hand fly!" put away the sandwich papers, extinguish cigarette, pull the seat forward and disengage autopilot for the descent to meet Paris Zone requirements. Because pitch attitude is controlled only by the trimmer, I could just as well trim into the descent. If the trim setting is not quite right, the Comanche hunts in a slow phugoid until it finds its level again. Nevertheless, I must get some handling time in.

At 20 n.m. the left/right needle becomes very sensitive, telling me that the beacon is getting close. I plan to fly the appropriate radial from Pope to Toussus and am at 1,000ft by the time the needle wanders and the To flag changes to From. Minutes later up comes Toussus on the nose and I change to communications frequency and make the landing. This is the easiest approach to Toussus I have ever had. The weather is not bad, but Toussus is not too well signposted by landmarks. With VOR we hardly watch the ground below and look only for the airfield ahead.

We are both fresh and happy after this successful first experience of VOR, autopilot and Comanche comfort. The more the merrier. Overall speed has been 122kt. Tanks are topped up with 24 Imp gal, making 15.1 gal/hr for engine running time, but if we reckon that Gatwick, not knowing the Comanche filling trick, gave us four gallons short then the consumption is the Lycoming book value of 13.4 Imp gal/hr. We weakened mixture only very slightly, and better consumptions were to come. Flight time 1hr 30min.

Toussus to Bordeaux (*260 n.m., straight line*) Morning take-off, hurrying against a 20kt head-wind, with a weak occlusion along track. Climb to 3,000ft, set 2,300 r.p.m. and 24.6in to make 172 m.p.h. indicated. Autopilot set on 220°. Tune Orly VOR and hear continuous weather reports in French and English. First ground-speed check gives 120kt. Identify, but cannot get bearing from Coulommiers at over 80 n.m. range. Estimate to receive Poitiers from the Loire. Orly not too well positioned for bearings. Just fly on, keeping general position check, but note ground speed down to 110kt. Am flying almost along occlusion, under cloud with blue to each side. Trim autopilot into gentle climb to get out of a haze-top. Cross the Loire and get Poitiers VOR uncertainly at 60 miles.

I keep homing on Poitiers and find the groundspeed gradually increasing as I seem to come out to the west of the occlusion:

Look, no pilot! Height, 4,500ft; speed, 158 m.p.h.; climbing at 500ft/min with 2,200 r.p.m. and 24.8in. The autopilot was engaged and the pilot was in the back seat

Full house: the fourth suitcase about to be stowed in the luggage compartment by Lambert; Stuart Cassy preparing to supervise boarding passengers. Note Storch in left background

120kt after 100 n.m. A US Army Otter flies past on reciprocal below me. Overall groundspeed is now better. Pass Poitiers, trying unsuccessfully to hear the marker. Three-quarters of left tank used in 80min, means tank should be empty in 1hr 45min. Following Poitiers 225° From radial steering 220°. Flown 160 n.m. in 79min, 122kt overall; measure 78 n.m. in 36min, making present groundspeed 130kt at 4,500ft.

Almost home and dry and busy with final slide-ruling when the engine cuts dead—the left tank is empty. I switch to the right and wait hopefully as the nose goes very slowly down. The engine picks up again and we level off. The autopilot has not been disengaged since Toussus. Tank ran dry in 1hr 38min instead of 1hr 45min, making 14.1 Imp gal/hr including take-off and taxying. I see Cognac bomber base and then the Gironde looms up. Track in on Bordeaux VOR, call on 119.7 Mc/s at 30 miles and make straight-in approach. Tower asks "What type of aircraft is that?" as soon as I touch down. Nobody knows the Comanche in France. It feels good to taxy onto the apron with the prop just whispering.

Total flight time, 2hr 10min and fresh as a daisy. Block speed, 120kt and total fuel consumption 13.4 Imp gal/hr.

STAGES AND TIMES

Leg	Distance n.m.	Flighttime hr min	Speed kt	Fuel added to fill tanks Imp gal	Engine running time	Imp. gal/hr
Kidlington						
Gatwick	70	00 45	94	7	.50	8.4
Toussus	183	01 30	122	24	1.35	15.1
Bordeaux	260	02 10	120	30	2.15	13.4
Toulouse	120	01 00	120	11.6	1.15	9.3
Issoire	151	01 10	129	—	1.15	8.6
Bourges	100	00 50	120	18	.50	
Toussus	100	00 50	120	11.6	.55	12.7
Lympne	172	01 20	129	—	1.25	8.2
Fairoaks	74	00 35	127	—	.40	
Kidlington	60	00.30	120	22	.35	

Bordeaux to Toulouse (*120 n.m.*) A desperately routine flight in fine weather along the Garonne from Bordeaux VOR to Toulouse VOR. Local rain-storm soaks Comanche while I wait at the end of the runway for clearance to be sorted out, but not a drop gets into the cabin. Take-off, set 75 per cent power and engage autopilot at 300ft in climb. Say "Good day" and tune VOR. At 75 per cent power and 125 m.p.h. I reach 5,000ft in 3min, trim into cruise at 6,000ft and set a new power, 2,200 r.p.m. and full throttle. This is lower r.p.m. than before and full throttle gives less than 75 per cent, but i.a.s. is still 165 m.p.h. I also weaken until the r.p.m. drop. Groundspeed measured at 136kt and then 138kt. Suddenly spot the Pyrenees, snow-capped, floating above a haze-top to the south—like Japanese prints. Disengage autopilot in increasing turbulence and then let down to Toulouse and land in 20kt wind, slightly cross. Overall speed, 120kt and fuel consumption a remarkable 9.3 Imp gal/hr. This is what Pipers claim. Obviously one must use lower r.p.m. and ruthlessly weakened mixture, plus high cruising altitudes.

Toulouse to Issoire (*151 n.m. along track*) A difficult flight in strong wind and often severe turbulence, flying towards the *Massif Central* in unfamiliar scenery—and without VOR. Toulouse VOR is off and nothing helps me find Issoire, so climb the sloping ground and follow railways and valleys. Visibility from the Comanche is not adequate to make such map-reading at all comfortable and I work quite hard, often reducing speed in the rougher air. Finally, I pass over two snow-topped summits at 9,700ft, the Comanche sailing along happily. Open d.v. window at 148 m.p.h. i.a.s. to take photographs. Using 2,300 r.p.m. and full throttle giving 21in in weak mixture. Outside temperature 36°F and cabin heater on. Descend cautiously to Issoire's little grass field and touch down smoothly. Block speed 129kt, but measured 160kt groundspeed for first 91 n.m. at 7,500ft.

Issoire to Bourges (*100 n.m.*) Did not refuel. Another routine trip, though still no VOR and no track drawn on map. Trying to get clear of severe turbulence I climb to 7,000ft, but it is no use for the first half hour. Again set 2,200 r.p.m., full throttle and weak mixture, but then try the chart value of 2,400 r.p.m. and full throttle to get the full 75 per cent power. Groundspeed measured as 157kt. Slow down several times in really rough bumps: 80 n.m. in 37min makes 130kt, the turbulence beginning to tell. The Comanche wanders and snakes in this really rough stuff, but the autopilot seems perfectly able to cope when I briefly turn it on. Block speed to Bourges is 120kt. Refuelling shows a highly satisfactory consumption of only 8.6 Imp gal/hr for two flights, mainly due to repeated slowing down, high altitudes and generally low r.p.m.

Bourges to Toussus (*100 n.m. along track*) I want a leisurely flight, but each time I am in a tearing hurry. Glad I flight-planned on assumption of 75 per cent all the way. Shortly after take-off, I realise my great ambition to set the autopilot, climb into the back seats and take photograph of unoccupied pilot's seat and instruments (reproduced here). I trim slightly forward to allow for aft c.g. movement and fire away with camera for several minutes. For some reason I get concert music through the loudspeaker. My luxury is complete. But Delta Lima is obviously a little unstable with well-fed journalist in back and only "George" holding the fort, so I get back to business and tune Orly VOR at 60 n.m. range from 5,000ft. Plan to find Toussus by radio only, so fly till west of Orly VOR, turn right to intercept 150° From radial of Pope and then track down this radial to Toussus. Nothing to it! Block speed 120kt, but fuel consumption up to 12.7 Imp gal/hr because I used 75 per cent at lower altitudes.

Toussus to Lympne (*172 n.m. along track*) This is a full-house trip, with Stuart, self and two other passengers, the luggage compartment full of suitcases, parcels shelf crammed with hats, packages and odds and ends, tanks full and Delta Lima a little down by the tail. Take-off feels as if I were flying solo. Nervous female passenger adusts ventilators and settles down nicely, small girl falls asleep, peace reigns. Only Stewart and I are working like fiends in front, identifying every VOR in Europe and then some! There is a mild front across our track and we cross Pope VOR and climb above a layer of cloud to 4,500ft. No ground in sight after 10min. We fly Pope 350° From radial and cross-plot on Cambrai TVOR. Put away half-million maps and use only Aerad EUR.6 radio chart—the new one, which is a honey. With pen and ruler I plot cross-bearings as we track up the unseen coast from Dieppe towards Le Touquet, which we have to call. Communications bad, but we pick up a QTE of 060° and continue following the coast with VORs. Now getting Dover, still above cloud, and plan to let down from 4,000ft westwards along the Dover coast, keeping clear of airways.

Letting down through a dense haze, the first thing we see is Dover harbour after an hour above cloud. Who would fly without navaids? Passengers still blissfully content in back, despite constant VOR idents we keep pushing through the loudspeaker so that we can both hear them. If only we had crystal-controlled VOR we could dispense with this, but the Omnigator needs constant identifying as cross-bearings are taken. We follow Dover and Lydd radials to pin-point Lympne in the haze and land. England is "strength five" with a frustratingly dilatory Customs clearance. One man working a twelve-hour day must reasonably go away for meals, but why must a half-hour tea break intervene 30sec after we touch down? It is not his fault.

Time from Paris, 1hr 20min, 129kt. We do not refuel.

Lympne to Fairoaks (*74 n.m. along track*) Knowing the Comanche and Omnigator we set off without a qualm in weather which would otherwise worry us. Mist is dense and the sun low and straight ahead. But we track onto Lydd 290° From radial, skirt the Gatwick zone using cross-bearings from London VOR, turn north to intercept the appropriate London radial and up comes Fairoaks on the nose. No need to look out of the side-windows, it's right there in front.

Fairoaks to Kidlington (*60 miles along track*) The short trip home to Vigors Aviation, taking a visiting German girl for the ride. There is plenty of endurance left without refuelling and the

(*Concluded on page 778*)

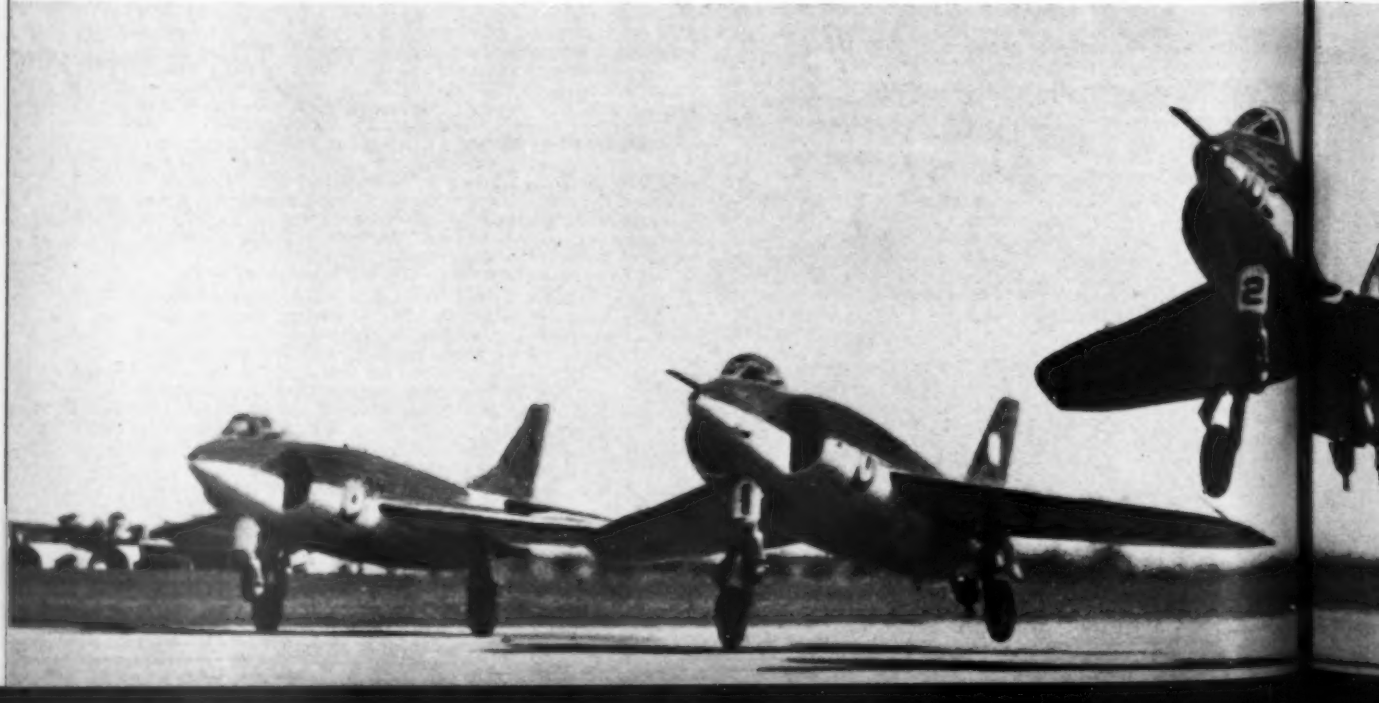
Representing the Royal Navy at the Paris Aero Show is the aerobatic team of 800 Sqn, based at Lossiemouth and commanded by Lt Cdr D. P. Norman, AFC, RN. Since its formation in June 1933 this famous unit has been equipped with Hawker Ospreys and Nimrods, Blackburn Skuas, Fairey Fulmars, Hawker Sea Hurricanes, Grumman Hellcats, Supermarine Seafires, Supermarine Attackers and Hawker (AWA) Sea Hawks. It converted on to its present equipment—Vickers-Supermarine Scimitars—on July 1, 1959. Powered by two Rolls-Royce Avon turbojets, the Scimitar is employed for day fighting, ground-attack with guns, bombs and rocket projectiles, or—with an interchangeable nose section—oblique photography. The two leading aircraft in the picture below carry flight-refuelling probes.

Box Four inverted—the 800 Sqn aerobatic team at the top of a roll

Lt M. K. Johnson concludes a practice sortie

800 SQUADRON

Down among the daisies the cameraman waits until he sees the whit

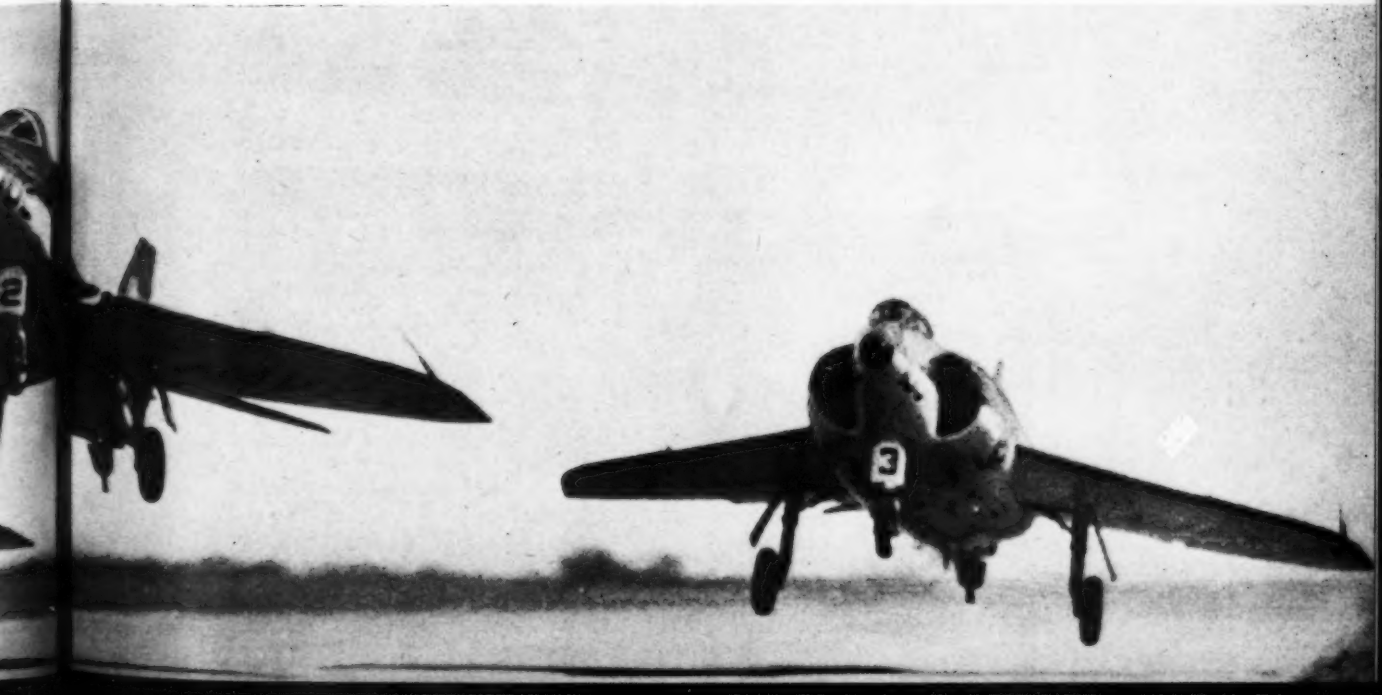


Below, the Squadron's Senior Pilot, Lt J. A. D. Ford, is strapped into his Martin-Baker ejector seat by Naval Airman I (AE) Derek Lambert. Right, a pre-flight briefing by Lt Cdr Norman

a roll

ONT PRACTICE FOR LE BOURGET

he whilst...



Napier, Luton

A Chronicle of Twenty-one Years of Research

IN *Flight* for June 27, 1958, we recorded the 150th anniversary of D. Napier & Son Ltd, engineers, of Acton, London. During some 50 years of their existence the company have been renowned for their aircraft engines, which today form an important segment of their operations. Originally, the job of supplying an aero engine ended when the unit had been proved on the bench. The airframe manufacturer bought the engine and installed it himself, and after he had been told the power, and what was required in the way of a cooling radiator and oil system, was largely left to his own devices.

During the inter-war years the Air Ministry supported the aircraft companies, who felt that engine firms were shirking part of their responsibility, and ordered that in future all engines must be flight-tested and proved as fully developed installations before delivery. In fact, all engine companies seeking Air Ministry business were bidden to form *ad hoc* installation and flight-development establishments.

In 1939 Napier formed the nucleus of such an establishment at Northolt, but this airfield was wanted for operational purposes, and early in 1940 the company chose Luton, Bedfordshire, as an alternative. The man appointed to run the new establishment was Mr C. L. Cowdrey, who had previously been chief designer of the Rolls-Royce installation department. He started as chief installational engineer. Today his title is general manager, Luton, and under his direction this branch of the company have handled research, development and production tasks probably more varied than anything accomplished by any other aircraft plant of similar size in the world.

But in the beginning the objectives were limited, and the facilities at Luton even more so. Twenty-one years ago Luton was a grass field, and on the edge of it an ancient Bellman hangar served to house two Napier experimental aircraft, their machine shop, and everything else from the coppersmiths to the canteen. The new establishment also took over a small hut on the tarmac, which is still standing. Total staff consisted of Mr Cowdrey, a test pilot and seven engineers. No permanent building was erected until early 1941, when a new office block was put up to house the installational drawing office, previously located at the Acton works.

It is now possible to turn from Genesis to Revelations, and discuss what has been accomplished. Each programme is numbered according to the date of its inception.

(1) Fairey Battle (Sabre) Throughout World War II Napier's greatest task was the development and manufacture of the remarkable 24-cylinder Sabre engine (described in *Flight* for March 23, 1944). It first flew in a Fairey Battle, which was converted by Fairey at Heathrow just after the outbreak of war. This machine, fitted with the 2,200 h.p. Sabre 2, destined for the Hawker Typhoon, was the first Napier aeroplane to arrive at Luton in March 1940. A second specimen was converted to Sabre power at Luton.

(2) Handley Page Hereford (Dagger) Although the air-cooled Dagger was not built in great quantity, it saw service in two RAF types, and Napier used L6002, one of the first Herefords built by Shorts, to find solutions to problems of oil aeration and engine cooling. The Hereford flew at Luton in May 1940, and several similar bombers were flown to Luton for modification.

(3) Folland 43/37 This big wooden aeroplane was designed specifically for flight-testing large engines, and three were powered by Sabres, the first flying in 1940. One of these was fitted with wing radiators, this installation being completed at Luton and the wing thereafter being shipped to Folland.

(4) Blackburn Firebrand (Sabre) Between 1940 and 1942 the Luton establishment designed a complete Sabre 3 powerplant for the Blackburn Firebrand torpedo fighter. It was the first self-contained engine-change unit in Britain, and possibly in the world. The complete package was neatly slung from forged light-alloy bearers, the first produced outside Germany. Only five such powerplants were manufactured, owing to Lord Beaverbrook's decision to allocate all Sabre production to the Typhoon.

(5) Hawker Typhoon (Sabre) Flight development at Luton began in September 1941, and for the next three years was by far the largest task assigned to the establishment. At one time 16 Typhoons were at Luton for the development of Sabre 2, 3, 4 and 5 powerplants. Oil and coolant systems were progressively developed to handle the increasing engine power, and several special installations were flown, including a calibrated engine in a cleaned-up airframe

● **The number to each picture caption refers to the correspondingly numbered section of the text. Not all the 43 sections are illustrated.**

3 *Left, Folland 43/37 (Sabre)*

1 *Below, Fairey Battle (Sabre)*

Windscreens by TRIPLEX

MARCONI DOPPLER

IN THE ARGOSY C Mk.1

The *Armstrong-Whitworth Argosy C Mk. 1 for the Royal Air Force Transport Command will be fitted with Marconi AD2300B Doppler Navigator and Track Guide Computer.

** They will also be fitted with the Marconi AD712 Automatic Direction Finder.*

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87

4 *Blackburn Firebrand (Sabre)*

5 *Hawker Typhoon (Sabre)*

Napier, Luton . . .

instrumented for precise power measurements. An extended-span Typhoon was developed with GEC turbo-blowers in the added inboard sections of the wings, and much work was expended in tropicalization and winterization. When Luton were advised of the alarming unserviceability of Typhoons operating from abrasive-dust strips in Normandy, a momentum-type dust separator was designed, manufactured, installed and test-flown in an elapsed time of 8hr. RAE tests showed that the filter had an efficiency of 92 per cent.

(6) Hawker Tempest (Sabre) Evolved from the Typhoon 2 project, the Tempest was one of the fastest of all piston-engined fighters, and Luton investigated various Sabre installations. In 1946 performance was further improved by the evolution of an annular radiator. Airflow was controlled by varying the circumferential exit area, and a cooling fan was provided to keep down coolant temperatures during prolonged taxying. The ultimate development matched the same annular radiator with a ducted propeller spinner, but research was discontinued owing to the advent of the turbojet.

(7) RAE test nacelle The first major project completed for an outside customer was the design and manufacture of a large streamlined nacelle for the open-jet tunnel at the RAE, Farnborough. Mounted on a lofty pylon, it was intended for evaluation of a range of propeller/engine configurations.

(8) Vickers Warwick (Sabre) With an eye on possible civil applications, a pair of annular-radiator 3,000 h.p. Tempest powerplants were successfully flown in a Warwick C.3 transport.

(9) Avro Lincoln (Naiad) The company's first gas turbine was the 1,500 e.h.p. Naiad turboprop (*Flight*, August 12, 1948). In 1946 Lincoln RF530 was received, and a Naiad was installed in the nose. This was the first of many special Luton flying test-beds, and with it much flight development of the Naiad was accomplished.

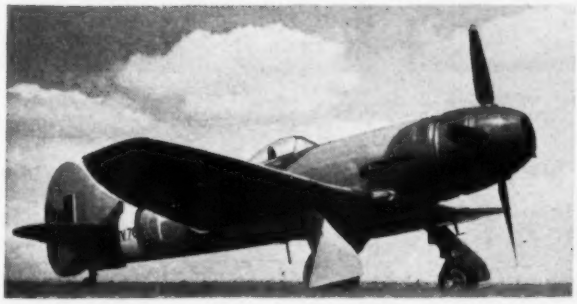
(10) Naiad Ice Protection In 1948 another Lincoln, RF402, was equipped for anti-icing research. In the nose was mounted a Naiad carcase containing only the compressor first-stage rotor blading. The latter was windmilled at the correct r.p.m. by the propeller and gearbox, and a water spray head was mounted concentrically in front of the intake on the end of a long tubular boom.

(11) Naiad-Viscount powerplant Three turboprops were originally considered for the Brabazon 2B airliner, which ultimately became the Viscount. One was the Naiad, and an entire engine-change unit was developed at Luton, embodying a ducted spinner and an oil cooler mounted in the lower "petal." In Napier's view, the final Viscount powerplant, now flying on many other types of aircraft, "copied to a large extent" this pioneer Naiad installation, a display model of which has for many years been at the College of Aeronautics at Cranfield.

(12) Vickers Wellington (Naiad) Before MoS support for the Naiad was withdrawn, Wellington NA857 had been largely converted to Naiad power.

(13) Avro Lincoln (Double Naiad) During 1949 the Napier Double Naiad was earmarked as a possible powerplant for the Blackburn YB.1 anti-submarine aircraft, and plans to flight-test the engine in the nose of a Lincoln reached an advanced stage.

(14) Double Naiad intake rig As its name implied, the Double Naiad consisted of two power sections geared to coaxial propellers. A full-scale rig was built to determine the effectiveness of the momentum-separation principle of air filtration employed in the wartime Typhoon intake, and this was re-erected at the RAE.



6 *Hawker Tempest 5 (annular radiator and ducted spinner)*

(15) Avro Lincoln (Phoebus) The establishment's first contract for a flying test-bed for another engine company was placed in 1947, when the Bristol Aeroplane Co charged Luton with the task of equipping a Lincoln as a test bed for the Phoebus. Essentially the latter was a pure-jet version of the original Proteus, built to provide data parallel with that obtained during the early development of the turboprop. Napier installed the engine in the weapons bay; each bomb door incorporated an intake feeding a plenum chamber, and the jetpipe was inclined down at the rear. After delivery to Bristol the aircraft performed a great deal of experimental flying.

(16) Vickers Viking (icing) During World War II the Germans developed an electro-thermal de-icing element consisting of a coarse fabric mat with a woven-in wire element, the whole then being enclosed in a plastic sheath. The MoS placed a contract with English Electric's Bradford factory (now the Aircraft Equipment Division) for further development of this material, and made available Viking VL229 as a test bed. English Electric delegated the work to Luton (Napier are a member of the English Electric Group), and thus triggered-off what is now the largest branch of Luton's activity. The Viking was the first icing test-bed of its type in the world. Inside the fuselage a Gipsy Six engine drove alternators serving a test overshoe mounted on an extension to the leading edge of the fin, behind a water spray mast looking like a small telegraph pole. Flight testing showed that the mat's chief facility was to burn holes in the test specimen, but the programme started a train of thought that has never ceased to grow.

(17) Fairey Spearfish (spray nozzles) Trials with the Viking brought to the fore the great difficulty of reproducing natural cloud conditions by spraying water from nozzles. So many variables determine the final droplet size and dispersion that Spearfish RA308 was equipped with a dorsal spray mast, the ice particles from which impinged on a special grid which could be continuously photographed.

(18) Spraymat The early trials with the woven heater mat started the company on a search for a better form of electro-thermal element which could carry heavy currents at elevated temperatures without giving rise to local hot spots. Moreover, the surface had to be applicable to modern leading edges subject to high speeds, and erosion due to rain and hail. The eventual solution was the Spraymat, in which the electrical energy is dissipated as heat in a sprayed-on metallic film lying between laminations of plastics, the outer sheath being hard and durable.

During the past ten years the demonstrated advantages of Spraymat have won it increasingly wide acceptance in all kinds of

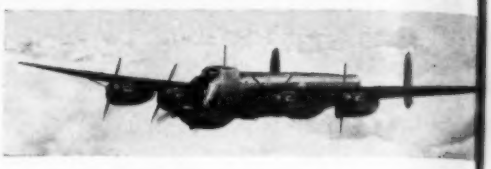
8 *Left, Vickers Warwick (Sabres)*

10 *Below, Avro Lincoln (Naiad icing)*

18 *Spraymat for Gannet AEW.3 intake*

19 *Red Shoes/Thunderbird (1440 test vehicle)*

16 *Vickers Viking (icing)*



22 *Right, Avro Lincoln (Nomad 1)*

Napier, Luton . . .

military and civil aircraft. Today it is found on most advanced British aircraft, and, through licensees—S.A. Bronzavia in France, Westfälische Metall Industrie KG in Germany and Flight Support division of Pacific Airmotive in the United States—Spraymat is currently fitted to, or specified for, the following aircraft: Argosy, tail unit; Belfast, tail unit; Beverley, combustion-heater intake; Britannia, tail unit; Buccaneer, intakes; Comet, auxiliary intakes; Gannet AEW.3, complete wing, tail unit and engine intake; Lightning, intake; Rotodyne, wing, tailplane and rotor blades; Seamew, intake; Valiant, intakes; Vanguard, tail unit and spinners; Victor, wingtips, intakes, dorsal intake and retractable a.p.u. intakes; Viscount, rudder horn balance and spinners; Vulcan, pitot mast; Wessex, rotor blades; Canadair CL-28 Argus, horn balances; Canadair CL-44, horn balances; Canadair 540, intakes and spinners; Lockheed C-130 Hercules. spinners; Lockheed Electra, spinners (Aeroproducts); Lockheed F-104G (including NATO production and Canadair CF-104), intakes; Martin Sea-Master, auxiliary intakes; NAA T-39 Sabreliner, wing leading edges; Ryan Firebee (J44 engine), intake struts; Breguet 941, wing and tail unit; Dassault Communauté, intakes and complete propellers; Nord/Transall C-160, complete wing and tail unit; Max Holste Super Broussard, intakes and complete propellers; Sud Alouette III, rotor blades; Sud Caravelle, heater panels; and Fokker/Fairchild Friendship, cold-air intake. Napier have found a very large number of applications in engines, guided weapons, electronics and general industry.

(19) Red Shoes In October 1948 the MoS charged English Electric with "the development of a ground-to-air guided missile." Initially given the code name of Red Heathen, it was later renamed Red Shoes, and today it is in service with the British Army as Thunderbird Mk 1. In a full description on September 25, 1959, *Flight* related how the whole vast programme began at a former RAF maintenance unit near English Electric's works in Stafford. "From Stafford—we wrote—the egg of the Thunderbird was taken to Luton, where D. Napier & Son, a member of the English Electric Group, had a major works. So here, early in 1949, a Seco-type hut was purchased from the Ministry of Works and erected within the Napier perimeter at Luton airport. The cost: £3,400. This was the beginning of what is now the largest guided-weapon factory in Europe, and which today, 11 years later, is still expanding."

At Luton the work was known cryptically as Project 1440, and Napier built up a strong team of designers and engineers to explore such fundamental factors as the best missile configuration (moving or fixed wings, nose or tail control surfaces, and the optimum type of boost system), and the best form of propulsion. A liquid-propellant sustainer had been specified; Napier set about choosing the fuel and oxidant, and determining how these fluids could best be expelled from their tanks under conditions of violent flight acceleration. Eventually HTP and kerosine were chosen, and work began on the NRE.1 single-chamber engine. Three test cells were built in heavy reinforced concrete, respectively for the testing of turbopumps and ancillary equipment, complete rocket engines and complete missiles. All three cells were so arranged that an explosion in any one was isolated from the control room.

After model trials at Larkhill, full-scale missiles were built and their aerodynamic behaviour checked by launching with boost propulsion only. These were followed by a total of 32 "hot" D.3 rounds built at Luton and fired at the RAE Aberporth (the photograph shows the launch of September 28, 1951). By this time the Napier team had translated the original requirement into a firm and successful programme of hardware, but to rationalize the work it was decided to pass over to English Electric's rapidly growing Guided Weapons Division all work on Red Shoes, together with buildings and staff.

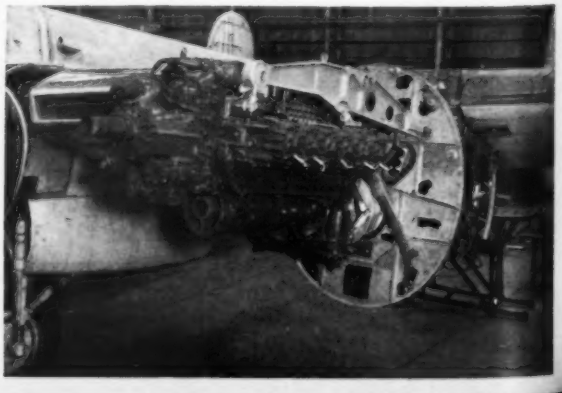
Responsibility for the sustainer propulsion remained with Napier, and, after producing 63 increasingly successful test engines, culminating in the double-wall, machined-chamber NRE.11 series, the design was dramatically cleaned up and simplified under the designation NRE.17. With a sea level rating of 2,000lb, the NRE.17 had a single-wall, ceramic-lined chamber, and was almost certainly the cheapest liquid motor of its size ever built. Nevertheless, this work also came to a halt, for in the D.4 test vehicles English Electric switched to a solid sustainer, such propulsion appearing preferable for army use.

(20) Liquid-propellant rocket research In 1950 the Luton establishment was awarded two contracts from the RAE/RPD, Westcott, for the design and development of an HTP-driven turbopump for nitric acid and kerosine and for basic research into the practicability of using a monofuel. Much work was devoted to finding a reasonable mixture of fuel and oxidant, but Napier's conclusions were that all such pairs of fluids "are essentially incompatible."

(21) Ramjet development In 1950 the National Gas Turbine Establishment at Pyestock asked Napier to provide the engineering and manufacturing support needed to conduct a programme of free-flight trials aimed at developing the optimum automatically controlled ramjet fuel system. The NGTE laid down basic requirements, and when the programme was terminated in 1958 a total of

21 *Left, NGTE ramjet test vehicle*

24 *Below, Avro Shackleton (Nomad)*



31 *Airspeed Ambassador (Eland)*

25 *Rotor tip-drive rig*

34 test vehicles had been launched, incorporating five progressively more elaborate fuel systems. One reached M2.3, another an altitude of 114,000ft.

(22) Avro Lincoln (Nomad) Acton had long laid stress on thermodynamic efficiency in an engine, and after World War II set about combining a compression-ignition piston engine with a gas turbine in such a manner as to achieve an overall pressure ratio of 31.5 : 1 and a specific fuel consumption of the order of 0.33 over almost the entire range of operating conditions. On April 30, 1954, *Flight* published a full description of the powerplant, by which time flight trials with a Lincoln had been completed. The engine which flew was the original Nomad 1, with separate coaxial propellers driven independently by the piston engine and gas turbine. This engine weighed over 4,000lb, and its accommodation in the nose of the aircraft was not easily accomplished. The photograph shows this test bed flying on the power of the Nomad alone.

(23) Centrifuge As part of the test equipment built for Project 1440 Napier constructed in 1952 an underground centrifuge consisting of a 20ft-diameter chamber containing a powered arm along which could be fed gases, liquids, electric power and instrumentation. A maximum axial acceleration of 100g could be sustained, and the equipment was found particularly of value in the development of the ramjet fuel system already mentioned. The centrifuge is continually in demand both by Napier and other manufacturers.

(24) Avro Shackleton (Nomad) During 1952-3 the design of the Nomad was refined and simplified, and Napier received a Shackleton MR.1 for use as a test-bed. An installation was prepared for a beautifully cowled Nomad 2 in each outboard position, with radiators in the leading edge. The project was cancelled when conversion had reached an advanced stage.

(25) Hunting Percival rotor rig As described in our issue of December 23, 1955, Napier's neighbours at Luton—Percival Aircraft until 1955, then Hunting Percival and now Hunting Aircraft—conducted extensive research into the problems of producing a tip-drive helicopter, and eventually received an MoS contract for the P.74. For this application, Napier produced the Oryx gas-generator, in which the entire mass flow, cooled by air from an auxiliary compressor, was fed through the rotor blades and discharged without further combustion. Napier constructed a special rig in which full-scale running could be done on rotors up to the size of that for the Rotodyne. In fact, during most of its life this installation has been devoted to shaft-driven rotors powered by a Napier Gazelle.

(26) Scorpion When the Thunderbird missile switched to solid propulsion Napier were left with a very attractive one-shot liquid motor with no application. According to the designers at Luton, "It happened that at about this time English Electric at Warton were looking for some means for boosting the performance of the Lightning fighter at high altitude under combat conditions . . . it was decided that the Napier engine should be turned into a two-barrel unit to double its thrust to 4,000lb, and at the same time develop it into a multi-shot unit, suitable for use on aircraft.

"Various development contracts were consequently given to Luton, and work proceeded for several years. At the end of 1958, when it could be said that the Double Scorpion was a reliable, effective and economic aircraft rocket motor, it was decided that the additional performance required could be obtained by incorporating afterburning in the Rolls-Royce Avon engines. All work on the Scorpion was therefore cancelled at the beginning of 1959."

(27) Vickers-Armstrongs Varsity (Eland) Most powerful engine ever produced by Napier, the Eland turboprop was described in *Flight* for July 23, 1954. Initial development of this 3,000/4,000 h.p. engine was funded by the MoS, and Napier were given a Varsity for use as a test-bed. At quite an early stage in development an Eland was fitted in the starboard position, with an overwing jetpipe, the original piston engine being retained to port. In this asymmetric form the aircraft flew in the summer of 1954, and during the first 10hr the Eland was successfully operated at 30,000ft and relit at 25,000ft—then believed to be the highest altitude at which this had been accomplished with a propeller turbine. An Eland was then fitted on the port side as well; the aircraft was comprehensively instrumented, and ended its life in peaceful retirement after several years of Eland icing trials.

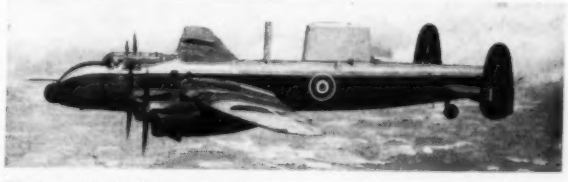
(28) Icing wind tunnel By 1954 a substantial part of Luton's work

27 *Vickers-Armstrongs Varsity (Eland)*

was concerned with protection against icing. In that year the MoS decided to terminate their work at a small refrigerated wind tunnel at Artington, Surrey, and Napier decided to retain the facility as a private venture. Their hopes proved justified, and this small establishment has paid its way commercially.

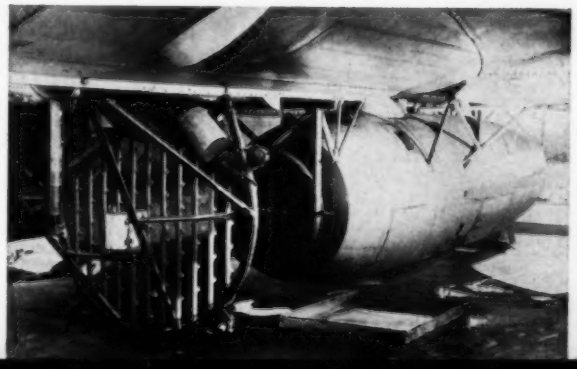
(29) Avro Ashton (Avon and Conway) In 1954 Luton were assigned the task of converting Ashton WB491 for employment as a versatile test-bed capable of undertaking high-altitude tests on turbojet and reheat problems for the NGTE. Initially an Avon was installed, in a self-contained pod beneath the fuselage, the MoS agreeing with Luton that the safety of the aircraft should in no way be affected by the test engine. During 1955, however, Rolls-Royce urgently needed such an aircraft for flight trials with the Conway by-pass engine, and WB491 was diverted to this purpose with the sanction of the MoS. The first flight of any Conway took place from Luton in the hands of a Napier test pilot.

(30) English Electric Canberra PR.9 English Electric subcontracted to Luton the task of modifying the Canberra for use as a high-altitude photo-reconnaissance machine. The alterations required were even more extensive than those superficially obvious, but in particular the 7,500lb Avons were replaced by 11,250lb Avon RA.24s, the intake, cowling and accessories were entirely redesigned, the inner wing was extended in chord to reduce t/c ratio, the outer wings were extended in span and terminated in square tips and the whole airframe was refined to reap the maximum reward from the great increase in thrust and altitude rendered possible. Luton handled all the engineering alterations, and converted Canberra WH793. Flight development showed the need for various modifications, one of the most important changes being the incorporation of powered ailerons, and the production aircraft

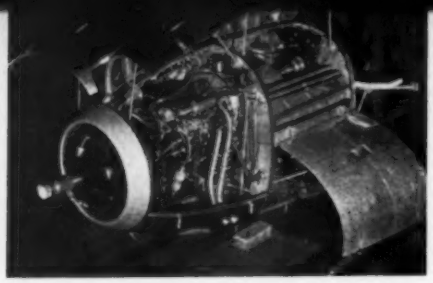


33 *Avro Lincoln (hot-gas icing)*

35 *Avro Ashton (Sapphire icing)*



36 *English Electric Canberra (Double Scorpion)*



38 *Eland powerplant*

Napier, Luton . . .

manufactured by Short & Harland have a hinged nose housing an ejection seat for the navigator.

(31) Airspeed Ambassador (Eland) During 1954 one of the first of the BEA Elizabethan fleet, RMA *Golden Hind*, was bought by Napier to conduct Eland route-proving trials. BEA had shown much interest in re-engining their Elizabethan fleet, and although de Havilland (who had acquired control of Airspeed in 1951) showed no interest in manufacturing a further batch of Ambassadors, so that the airline dropped its Eland proposals and eventually disposed of its Elizabethans, Napier found the aircraft valuable in flying the engine to simulated airline schedules. A 16ft D.H. propeller was used, and volute-type jetpipes were employed.

(32) Convair 340 (Eland) Neither the Varsity nor Elizabethan fully met Napier's requirements as an Eland test-bed, and when Luton were asked to select an airframe their choice fell on the CV-340. This aircraft had originally been designed to be capable of re-engining with turboprops in just such a manner, and it appeared to Napier that an Eland-Convair could well become a commercial proposition in its own right. Late in 1954 a new example was purchased by the company and converted to Eland power, each nacelle having an overwing jetpipe incorporating a heat exchanger for cabin heating and aerofoil de-icing. This aircraft, G-ANVP, carried out extensive development flying, and attracted so much interest that it was sent to California and, after lengthy and arduous demonstrations, was awarded the first unrestricted FAA type approval certificate issued for any turbine-powered aeroplane. Napier then purchased a CV-440, which was flown to PacAero Engineering Corp in Los Angeles for the installation of modified Eland powerplants built at Luton. Supplemental Type Certificates were eventually obtained in respect of both aircraft.

(33) Avro Lincoln (de-icing research) The Naiad-icing Lincoln RF402 was later employed in the high-altitude development of combustion heaters for the MoS. In 1955 the faithful Viking was placed on the retired list, and Napier equipped RF402 to carry on the work. After a series of trials with two types of combustion heater, the aircraft was equipped for the study of hot-air de-icing of the Beverley wing. The installation consisted of the outermost 5ft of Beverley wing, arranged to pivot about a vertical axis above the rear fuselage, together with a spray grid and extensive instrumentation. By this time Luton were able to simulate any type of icing at will, and the advantages of not having to search for natural icing was so marked that the company received contracts to carry out similar work for the Britannia and Comet. Meanwhile, a second Lincoln, RF342, was equipped for basic icing research.

(34) Helicopter Rocket Boost A by-product of the work on rocket motors was a boost system for helicopters by means of miniature nozzles at the blade tips fed with decomposing HTP from a tank mounted above the hub. Substantial performance improvements led to the equipment being fitted to Skeeters for the Luftwaffe.

(35) Avro Ashton (Sapphire) Armstrong Siddeley Motors (now part of Bristol Siddeley Engines) appreciated the value of an aeroplane like the Conway-Ashton, and in 1956 Luton converted an Ashton to carry a late mark of Sapphire, which thereafter did much research flying.

(36) English Electric Canberra (Double Scorpion) Napier installed a Double Scorpion in the rear of the bomb bay of Canberra B.2 WK163. The tiny package conferred a thrust at 50,000ft roughly equal to that obtainable from both main powerplants, and in 1957 this aircraft—flown by Mike Randrup, chief test pilot, and with Walter Shirley, the deputy chief engineer at Luton, as observer—reached a world record altitude of 70,310ft.

(37) Gloster Javelin (Avon) The MoS selected Javelin FAW.1 XA562 as a test-bed for an advanced Rolls-Royce Avon with reheat. Not only was a great deal of airframe conversion required, but the amount of special instrumentation surpassed anything previously necessary.

(38) Eland powerplants Although design and development of the Eland was an Acton undertaking, Luton were given the task of producing complete powerplants. The work began by the production of modification kits for the Brazilian airline REAL. These were never delivered, but in 1958 work began on the completely new power package for the CL-66 (Canadair 540) for the RCAF. Whereas the REAL kits had been designed for tropical operation, the CL-66 powerplant had to be suitable for extremes of climate, in addition to which Luton had to incorporate a Blackburn Palouste gas-turbine in each port installation to provide for pneumatic engine starting (and auxiliary power, if required), together with Americanization of threads, pipes and connectors. In contrast, the Eland powerplants produced for the Convair/Canadair 540s, for Allegheny and other operators, revert to the basic installation which received FAA approval in the CV-440.

(39) Gloster Javelin (Gyron Junior) The MoA authorized Luton to install a pair of de Havilland Gyron Junior DGJ.10R engines, to the standard of build required for the Bristol 188, in Javelin Mk 1 XA552. The problems of installing these very advanced powerplants proved a formidable one, and much time was expended in perfecting the control systems to the engine, afterburner and nozzle, but delivery was made last summer.

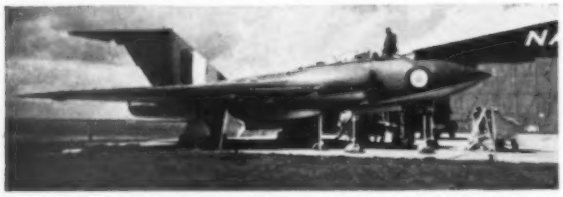
(40) Napier icing Lincoln When the MoA cancelled all de-icing research early in 1959, Luton considered that it would be commercially sound to continue such research on a jobbing basis available to all aircraft manufacturers. Accordingly the two Lincolns were purchased, RF402 being cannibalized to support RF342. On the fuselage of the latter have been mounted sections of wing and tail from the Caravelle, Argosy, Avro 748 and Buccaneer, and several further programmes are in hand.

(41) Improved rotor blade In 1959 the MoA were convinced of the promise of improved fatigue life offered by a form of helicopter rotor blade patented by Mr R. Clemens. Although they found a company to handle preliminary development, a new subcontractor was required to make full-scale blades. Luton were awarded a contract to manufacture 16 blades suitable for the Skeeter (later changed to the P.531 and Scout) plus some test specimens. Essentially the blade consists of a continuous double-wall D-nose spar, stabilized by thermosetting-plastic material, with a light metal trailing portion. Results so far are most satisfactory.

(42) CEGB test rig In an endeavour to diversify, discussions were held with the Central Electricity Generating Board, as a result of which Luton have produced a complete rig for the study of erosion and corrosion in steam-turbine blading.

(43) ICSE These letters signify intermediate current stability experiment, a large research machine for the UK Atomic Energy Authority intended to be a successor to Zeta as a further step towards the production of power by controlled fusion.

37 *Gloster Javelin (Avon)*



39 *Gloster Javelin (Gyron Junior)*

41 *Improved rotor blade*

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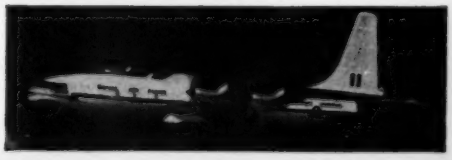

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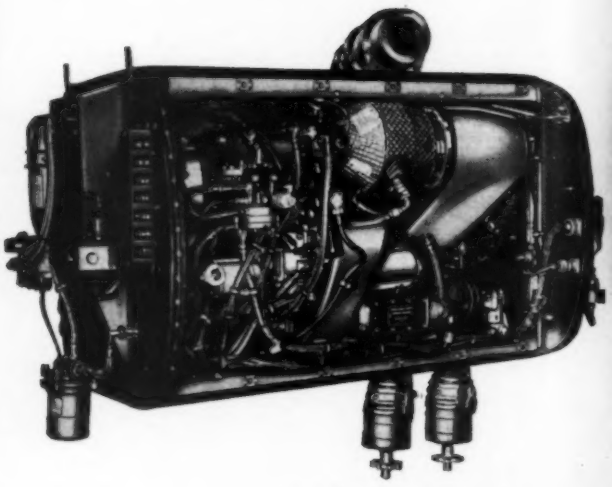

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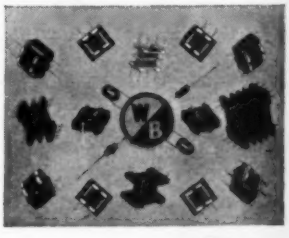

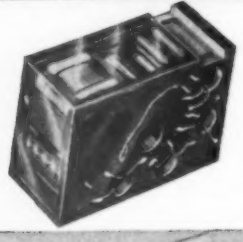

P.O. TRANSISTOR AMPLIFIER

This P.O. Transistor Amplifier moulding is another example of potted components, the illustration is of a development of a miniature version of the amplifier 100A, this model utilising transistors to replace the miniature valves.

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SPORT AND BUSINESS

Private View

BY P.P.O.

"Another way of enjoying your aeroplane is to take part in races and competitions . . ."

THE rallies season is now with us and we are all hoping for a fine summer to help us get the maximum fun out of them. The private pilot has a wide choice. He can go as far afield as Corsica, or he can content himself with visiting some of the excellent local rallies which are now being run in this country, such as at Elstree, or at some of the Norfolk airfields where there is so much growing enthusiasm.

Rallies should be and are jolly social affairs and, curiously enough, are best without too much flying. You come, you meet your friends and probably make a few new ones. And if you are sensible you leave in good time to get home before dusk. Please on no account try to show everyone present what a good pilot you are by performing some specially short landing. If you want to do that sort of thing, do it on a quiet aerodrome with no one looking on—to see you make a fool of yourself. It is a fact that after a longish cross-country it is very easy to misjudge a landing. The best mark of an experienced pilot is that he is never too proud to go round again if he is not too happy with his first approach. Then, when you have landed, stop still for a while to have a good look round and check the strength of the wind, especially on runways. You will be shown where to park, and organizers of rallies like to see the aircraft in nice neat lines.

The slipstream of an aircraft, even while taxying, can kick up a lot of dust, and blow ladies' summer hats about. The impression you want to create is that you are a careful, thoughtful pilot with good manners, not an ace just back from shooting down the enemy. Then you will probably be invited to come again.

For the rally *par excellence* you should go to France and, if you want to be really popular, preferably in a French aeroplane. They are held all through the summer, and the *vin d'honneur*, which is usually held in the hangar, is something to be remembered. It is a good idea to take your own picketing-down gear as there will be no room in the hangar. Incidentally, to be really Gallic you should take a tent and pitch it neatly by your aircraft. One of the nicest sights I saw last summer in France was a well-known British pilot who had brought his young family and, in the morning, had his aircraft decorated with babies' washing neatly pegged to a line slung from tail fin to wing tip.

★ ★ ★

Another way of enjoying your aeroplane that will be open to many this summer is to take part in some of the races and competitions which are mostly organised by the Royal Aero Club, although some of the bigger flying clubs probably will run some of their own. Undoubtedly air racing ranks high among the more exciting and averagely dangerous sports. It is not too common in this country, or, for that matter, anywhere in the world, mainly because it is difficult to get the public to pay very much good money to come and watch it, and consequently the expense has to be borne by the organizers. But it is the greatest fun to take part.

There are few more exhilarating feelings to be had in any sport than racing in close company with other aircraft of similar speed, with your left hand bending the throttle lever, and with your feet and right hand trying, like the good dinghy helmsman, to steer your craft with the least possible disturbance of control surfaces.

In air racing accurate turns and good hands show up the best pilots very quickly. I well remember in a recent short-circuit race trying desperately hard to catch up the man in front. My aircraft was slightly faster than his and on the three or four miles of straight I would slowly overhaul him, but as soon as we got to a turn he would gain fifty or sixty yards simply by the smoothness and accuracy of his manœuvres.

Air racing can be amusing to watch if it is well organized. Unfortunately the Ministry civil servants do their best to make things difficult by unintelligent restrictions. The important thing is for the public to get to know the pilots and the way they do their turns and fly their aircraft. If all the mounts are around the same speed, victory will inevitably go to the most skilful pilot. The unintelligent restrictions which I have referred to have unfortunately compelled the organizers to use circuits which are too long, so that for long periods of a race the pilots are out of sight of the crowd.

The only restrictions that could be useful as they could help safety without spoiling the race concern differing speeds of aircraft. Three or four aircraft all of about the same speed can go round pylons safely together, but a very fast and possibly rather "blind" machine charging through a bunch of slower machines on a turn can be a menace.

Yes, if the Ministry could take a holiday I believe air racing could be made to pay so as to provide pleasure and possibly profit for the pilots, an opportunity to improve the aeroplane for the manufacturer, and an amusing and exciting afternoon's entertainment for the public.

★ ★ ★

One bit of good news is that Berck, the airport on the French coast near a nice little watering place, and handy for Le Touquet, now has Customs, so that you can fly straight from Lympne to Berck to begin your French holiday. René Vallois and his charming wife will make you very welcome. So there is a few hours' wasted time knocked off our next weekend in France. I noted the time it took me to complete formalities there—2½ minutes. At Lympne they do their best but it takes at least 20 minutes, even if you don't have to wait for a Skyways load of passengers. Still, we progress, even if we are still letting our French friends show us the way.

However, getting the Customs people to behave does involve behaving ourselves. In the sailing world it is not at all uncommon for sixty or seventy boats each containing crews of seven or eight people to race across the channel and back for a weekend. Customs are never any trouble. You just hoist a quarantine flag as you enter port. And if a Customs man cares to come on board you give him a beer. If he doesn't, it is just too bad. But no yachtsman who is a member of a respectable sailing club, in spite of having plenty of room in the bilges, will ever indulge in smuggling. If he does his pals are certain to get to know about it, and he will be told very distinctly what a dirty trick he is playing on his fellow yachtsmen. So, on the whole, Customs men trust yachtsmen and are not disillusioned.

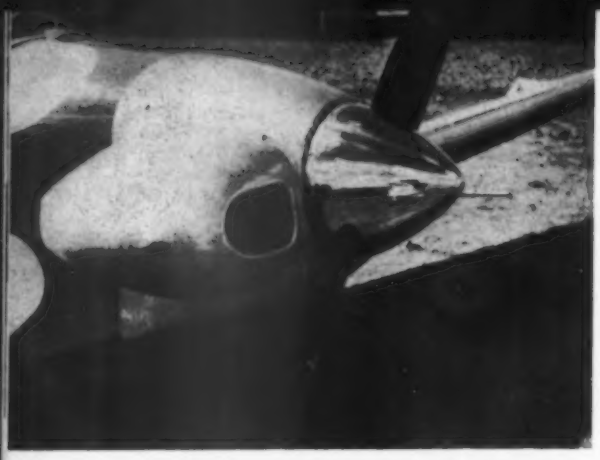
Why, therefore, they should imagine that those who fly light aeroplanes are any worse, I have yet to work out. Yet the palaver over light aeroplanes landing in this country is extraordinary. Surely it should be possible to telephone the local police or Customs man when you arrive at your home aerodrome, having reported to the CFI of the club, who would make sure that you didn't run away. This would be a far simpler procedure and less expensive to the taxpayer than keeping a Customs man permanently hanging about in good weather and bad, it being clearly understood that anyone who smuggled, whether caught or not, was simply *persona non grata* in the flying world.

It might be said that this places too much responsibility on the local CFIs. I am quite sure that for the good of private flying they would be willing to assume it. After all, the one certain lesson that all private pilots learn as soon as they go on their first cross-country to another licensed airfield is to taxi to the building with the large "C" on it and report their arrival. If they announced that they had come from abroad, it would not be difficult for whoever was in charge to telephone the local police or Customs and ask the pilot to stay near his aeroplane until the official arrived.

A short while ago, by *force majeure*, I had to do just this. After waiting about 45 minutes the local excise officer arrived in his little car, at first a little shocked at the unconventionality of the affair but, being a nice chap, he soon realised that everything was quite above board. After looking at my documents, he released me to go about my business and we parted the best of friends. Of course, in due course, I received a letter uttering fearful threats if ever I did it again, so don't blame me if you try it and land yourself in gaol.

Perhaps one day the Customs will realize that, like other public servants, their duty is to serve and assist citizens to go about their business and pleasure with as little hindrance as possible; and that laws were made for man, and not man for laws, and States for the good of people, and not people for States.

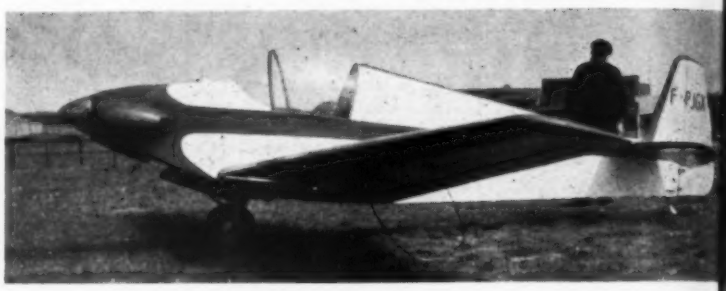
SPORT AND BUSINESS . . .



Power for the RF.01: a Miettaux Volkswagen conversion

FLYING FOR FUN IN THE FOURNIER

SINCE its first appearance in public last August it seems doubtful whether any other aircraft has achieved such enthusiastic interest as the Fournier RF.01 Avion Planeur, more colloquially known in its native country as the "bébé U.2." Certainly, many claims have been made in the past that a certain aircraft offers something new in the flying world, only for such claims to be discounted in the hard light of subsequent experience. In the case of the Avion Planeur (literally "aeroplane glider") which has already achieved wide renown in France, such a claim seems to be well justified. Certain types of aircraft give the pilot an impression right from the first minute of getting aboard that they are old friends. The Avion Planeur, to the writer at least, is in just that class.



A single-wheel undercarriage and under-wing balancing hoops are novel features

Without any doubt there will be cries of alarm from the soaring purist at the appearance of this device, and equally the opposite full-power purist will pour scorn on the idea. Between these two points of view, however, there is no doubt that a world-wide, large, and unsatisfied demand exists for a way of flying cheaply in a versatile aircraft, rather than in something limited to one particular set of weather conditions.

Many attempts have been made in the past by a variety of designers to achieve, in a practical package, the desirable ability to soar silently like a bird, with the added advantage of being able to turn for home when responsibility or conscience dictates. Some of the past efforts have been lamentably bad, being neither good aeroplanes nor good gliders, and yet at the same time being expensive, overcomplicated and undesirably sophisticated for real service in the field. In fact, to use an excellent French word, they have not been *rentable*.

René Fournier has attacked his problem in a different and refreshingly practical way. He has appreciated the need and has designed for a straightforward, easy-to-maintain-and-repair type of structure—a disappearing art! He has openly acknowledged the simple box fuselage of the Jodel D.9 and made good use of the basic design. To his simple fuselage he has added a high-aspect-ratio wing and some well-proven and practical means of reducing drag. An enclosed cabin, smooth cowling with pressure cooling, and a retractable undercarriage are all coupled with a good finish and a surface free from aerodynamic leaks.

The trapezoidal mainplane with a span of 37ft and an aspect ratio of 11 gives the Fournier a performance of the order of a Grunau Baby 2B when flown without power, and a satisfying 90 m.p.h. cruise at 2,700 r.p.m. on a converted Volkswagen engine. The profile varies between NACA 23015 at the root and 23012 at the tip. Wing structure is conventional sailplane type, with a single cantilever spar at 30 per cent chord with root-end drag bracing making a triangulated box in the root area. Ailerons are of constant chord and long span.

The most radical feature of the Fournier is the undercarriage—a retractable single-wheel arrangement reminiscent of the prewar racers in the Coupe Deutsch de la Meurthe. Lateral balance is ensured by two steel hoops, or *balancines*, which are disposed at about mid-half-span to act rather like the wingtip floats of a flying boat. They have been carefully arranged to allow just the right amount of lateral tilt to the aircraft at rest, to prevent undue dragging when taxying.

The cockpit: "Comfort and adequate spaciousness"

On entering the cockpit there is an impression of comfort and adequate spaciousness enhanced by the impressively thick cushions, that for the seat-back being provided with a zip-fastened compartment for documents and other lightweight impedimenta. The harness is a five-strap affair in nylon and gives a great impression of security without being in any way uncomfortable. The instrument panel is basic VFR except that, for obvious reasons, a variometer is installed.

Throttle control is by a small horizontal handle projecting from its mounting at the port top-longeron level. Hidden from view under the panel is the undercarriage lock release, this being another horizontal handle pulled backwards by the left hand to operate. The locks are spring-loaded plungers entering holes in a pair of large quadrant plates, one on each side of the undercarriage structure. Retraction of the wheel is by means of a large lever on the port side of the cockpit which, on being pulled back over centre, retracts the wheel and closes two small fore-and-aft fairing doors. Lowering procedure is similar, a smart pull on the lock lever releasing the wheel, which drops out with the aid of bungee cords. All that is then necessary is to ensure that the retracting lever is pushed home to full travel.

Monsieur Fournier is a prudent type and insists on giving a short briefing to all pilots who fly the Avion Planeur, partly in order that there shall be no mistakes with the undercarriage and partly, as he rightly avers, to ensure the maximum fun from the flight. There is no surprise in the briefing, however, and it is never long before the little Miettaux conversion of the Volkswagen is running like a staccato version of a sewing machine. During the warm-up and power check a motor-cycle brake lever, mounted at the top of the control column, provides an agreeable method of braking.

Taxying is surprisingly simple and with the help of the steerable tailwheel is, in fact, more positive than in many conventional types. Visibility through the moulded screen and canopy is completely adequate and a full view is enjoyed at all times.

For take-off it is merely necessary to point the aircraft and go, man, go! A very natural inclination seems to exist to hold the wings level, and both rudder and aileron control are fully adequate

Right, close-up view of the starboard "balancine." Far right, the designer, René Fournier, at the tail of the Avion Planeur

from the start. Take-off run seems to be about 100-150yd from grass with virtually no wind.

The Fournier flies itself off and there is a satisfyingly safe feeling in the initial climb. A tug on the lock lever which, although invisible, comes easily to hand, and a surprisingly light heave on the long retraction lever produces an experience akin to a large and friendly dog leaping into the pilot's lap, as the wheel comes up and tucks itself between one's knees. The obvious objection caused by having taxied through a field of cattle is best avoided in the prototype by a wise choice of fields. Later models will have an enclosed wheel-bay.

Climbing at 90 km/hr (56 m.p.h.) and full throttle is completely comfortable and the effect of any thermal activity is soon noticed, permitting climb and level flight at will with the throttle fully closed. At 2,200 r.p.m. and an i.a.s. of 100 km/hr (62 m.p.h.) there is a most acceptable flight regime enabling the unskilled to search for thermals in reasonable quietude, or the lazy to just fly around enjoying the scenery at one gallon per hour!

Stalling is very gentle, a straight stall arriving at 65 km/hr (40 m.p.h.) i.a.s. Let it be noted here that this is an honest, and not a "fiddled," figure. The Fournier meets current CAR requirements, which insist on more truthful ASI indications than we have been used to for some years on light aeroplanes. Little height is lost and, although there is no buffet before the stall, failure to recognize its arrival in straight flight would seem remote.

Unfortunately, no elevator tab is fitted, and the elevator load is light—too light, in fact—and thus longitudinal stability checks are difficult. On the prototype it is quite easy to apply a goodly amount of g; this is being improved on later models.

Control damping is good and the controls have a pleasant feel about them, smooth and effective. On the glide there is a slight heavying of the ailerons, but at all speeds the rate of roll is very good. From 30° bank through to 30° opposite bank gave a consistent two-second reading on a stop-watch.

Crossing controls at 1.3 stalling speed and releasing either results in the nose centralizing and, in the case of releasing both, the nose centralizes with a moderate nose-down pitching.

In cruising flight the Fournier comes into its own, providing a smoothness which is entirely different from any other ultra-light experienced or imagined. In bumps the Avion Planeur is really at home and in all conditions of cruising there is a peculiar impression of clipping through the air without fuss—the nearest impression to mind is that of a sailing catamaran. Flying low over open country accentuates this feature, which has been remarked upon by all those who have flown the aircraft.

It is sad to face up to the decision to land, such is the charm of this aircraft, particularly if the engine has been stopped and a spell of soaring flight enjoyed. The propeller stops horizontally and, pending the fitting of a re-start device (already developed on a Jodel D.9), a steep dive is necessary, with a smart right-hand turn at the bottom, to force the engine to rotate.

An approach at 95 km/hr (59 m.p.h.) i.a.s. is very adequate and somewhat flat, although later versions will be fitted with spoilers. Landing needs to be made with a glider-type presentation and, provided that no attempt is made to hold the tail down, the Fournier greases on to the deck with a satisfying smoothness.

Because of its design factors the Fournier may be thrown about with some gusto and seems to enjoy the thrill of large swooping manœuvres, which acquire a grace of their own with the long wing which is fitted. Bernard Chauvreau, a French pilot who has logged considerable time on the Avion Planeur, puts on a show of *voltige* which is a study of grace. His inverted flying is particularly impressive and is usually performed without engine. Chauvreau has already startled the locals with a flight of over two hours, engine stopped, with no loss of height.

During its short existence the Avion Planeur has been a resounding success. It has been flown by French government pilots and, as a result, financial aid has been produced to build the pre-series prototype and a structural test specimen (UK bureaucrats please note). How British light aviation could advance if similar practical steps could be taken here to ensure that our young designers could have a fighting chance of a brain-child airborne!

The first batch of five Fourniers is to be made at Centre Est, Dijon, with production deliveries, ex works at about £1,350, next year. Fournier does not intend to supply plans to amateurs but may issue kits to approved constructors.

Improvements in the later versions include spoilers, a smaller and wider wheel with enclosed well, lower fuselage and canopy, together with small detailed ameliorations all seemingly destined to add to the future success of this sports pilot's joy. Production aircraft will have a full C of A and will meet CAR standards for cloud and instrument flying, and thus aerobatic strength will be adequately catered for.

HAROLD BEST-DEVEREUX

BRITISH OPEN PARACHUTING CHAMPIONSHIPS

THE first day of the recent British Open Parachuting Championships at Stapleford Tawney, Essex, may be said to have established parachuting as a British national outdoor sport. It mattered little that the weather was wet and windy and the landings erratic. What did matter was that the clubs were all there: The British Parachute Club; RAF Abingdon; Scottish Parachute Club; 22nd SAS; Oxford Parachute Club; Green Jackets; American Parachute Club of Great Britain; 1st Parachute Battalion; 21st SAS; Wanderers; British Skydivers; Southdown Skydivers; Ripcord Club; and the USAF Evreux Club of France. And perhaps the most definite indication yet that sporting parachuting in this country is "accepted" was the presence of a recruiting unit of the Parachute Regiment complete with its fan exit trainer.

Competitors were divided into two classes on the basis of experience. For the juniors there were four drops from 3,000ft with delay before opening of up to 10sec, followed by a precision landing. For landing in the centre of the target the maximum was 100 points, with one point deducted for each yard off, the best three jumps to count.

For seniors there were two jumps from 3,000ft, under the same conditions as the junior event, followed by two jumps from 5,000ft with a 20sec delay before a spot landing. Landings were marked as for the 3,000ft events, with an additional 200 points for the correct stable position in free fall and a deduction of 50 points for involuntary "aerobatics."

The difficult wind conditions on the opening day provided a test of parachuting skill to which few of the senior contestants were equal, and the surrounding countryside on and off the airfield soon bore the imprints of boots and bone-domes. The best performance of the day—and only the first jump of the senior 3,000ft was made by Peter Lang. One of the steady old hands, he brought his parachute in copy-book style to within spitting distance of the target, holding off against the wind with his steerable canopy until his altimeter told him it was time to hoist full sail and run for home.

Viewed with a critical eye, this part of the competition showed mastery of the free-fall position, but a sheep-like tendency to run the Tri-pacers wide of the target on the wrong heading, regardless of where the man before had landed. This run-in is, of course, in the hands of the parachutist and not of the pilot.

From the organization point of view, the British Parachute Association did a good job, and one can only admire their sheer determination in really bringing this sport to life. The farmer who permitted the target to be set out in the middle of his growing crops, will, of course, go down in parachuting history as a martyr, and his remark as he gazed sadly at his flattened corn summed up the feelings of many visitors: "I had no idea that the competition was going to be as big a thing as this!"

Half-way through the second day a decision was made to postpone the remainder of the championships until the following weekend, and to move the organization to Kidlington, Oxon, to avoid further damage to crops. On the home ground of the Oxford Parachute Club the sun shone and the wind died and the standard of parachuting rose rapidly. The championships ended with a win for Mike Reilly of the Ripcord Club with a score of 475 out of a possible 500, followed by Capt Strobaugh (USAF Evreux) with 466 and Peter Lang (Wanderers) with 453. In the junior event J. Johnston (Ripcord) scored 281 out of 300, followed by Sgt D. Francombe (Oxford) with 159, and R. Sawyer (also Oxford) with 156.

T. W. W.

The Ind Coope aviation team and their two Doves at Tatenhill airfield, near Burton-on-Trent. From left to right are Mr H. A. McCarthy, chief licensed aircraft engineer; Capt W. L. Evans, pilot; Mr R. Burston, mechanic; Mr O. Robinson, in charge of aircraft liaison; Capt D. L. Lancaster, chief pilot; and Mr D. Brown, mechanic. (See "Flying Brewers," below.)

SPORT AND BUSINESS . . .

FLYING BREWERS

A NICKNAME which Ind Coope have earned for themselves by operating their own aircraft for a number of years is "the flying brewers." It all started when Gp Capt B. G. Carfoot, one of the directors, flew his own light aircraft on business, taking company passengers when appropriate. Then it was decided to charter larger aircraft; and charter soon led to the purchase of a Rapide. The company estimated to fly 200hr in the first year with this type, but actually completed 586hr. The natural limitations of the Rapide dictated the purchase of a Dove 6 (G-APCZ), which has now been in use for three and a half years. Last December, Ind Coope obtained a second Dove 6 (G-ARDE) and the chief pilot, Capt D. L. Lancaster, was joined by Capt W. L. Evans.

The flying operation has been systematically planned and its use expanded over the years. Ind Coope have breweries at Edinburgh, Burton-on-Trent (company headquarters), Wrexham, Watford, Romford and Westerham and own 5,200 licensed premises, including 46 residential hotels. The recent merger with Ansell and Tetley Walker will considerably increase this total. Travelling commitments of executives and technicians in the company are therefore extensive; and the aircraft section, through the liaison of Mr O. Robinson, prepares a six-month printed programme of regular flights all over England. In addition, a more detailed programme for three weeks ahead is produced every Friday and both are issued on a limited circulation of about 100 within the company. There is a system of graded eligibilities by which certain people can claim seats or delegate them; and others can actually call for special flights to be arranged, spare seats on these also being allocated where possible.

The two Doves are based at Tatenhill, a wartime airfield near Burton, where the runways have been fenced off from surrounding farm land and partly resurfaced. The 1,200 yd runway has built-in lights, and goose-neck flares are available for the other. A hangar accommodates both Doves, and a permanent groundcrew of three, headed by Mr H. A. McCarthy, performs all maintenance, including C of A overhauls, to approved schedule. VHF communications on 122.2Mc/s and fire service are provided and a separate receiver makes it possible to listen to weather broadcasts on London and Preston control frequencies. The base is now to be extended to house another business operator. Both Doves carry full airline radio with stand-by VHF, and Decca Navigator with Flight Log charts specially prepared to cover most of the usual operating area from Glasgow to the South Coast on two chart cassettes. Approach charts are included for the main airfields and the usual tracks and distances are all marked to make navigation simple and quick. About 90 per cent of flights are made in England and about half on airways both by day and night. Off airways the Decca is particularly useful. One aircraft has the first of the new ATR-sized Mk 8 receivers, which are much smaller and lighter than the old Mk 8. Both Doves also have the Sperry AL.3 autopilot, gyro compass, night lighting and full de-icing equipment.

Reckoning that each aircraft is out of use for two months each year for C of A overhaul and that pilots' holidays take another month, there are about 196 "flyable" working days; and on all but two or three of these Ind Coope Doves are flying. In an average year there are perhaps two complete cancellations and six delayed or diverted flights. There has been one diversion this year and no mechanical delays. Regularity is therefore at least as good as for airline operations. The Doves are usually flown at +1lb boost and 2,250 r.p.m., giving a t.a.s. of 145kt. The second machine has already flown 225hr this year. The first flew 482hr in 1957-1958; 502hr in 1958-1959; and 652hr in 1959-1960. Increasing utilization is attributed to improved planning and scheduling.

The whole operation is meticulously costed and recorded. The books show that one Dove, between September 1, 1959, and August 31, 1960, completed 211,542 passenger-miles (passengers carried against straight-line miles covered). Cost, including 35 items such as rents, wages, pensions, insurance, aircraft and plant depreciation, ground vehicles, fire equipment, Decca rental and engine overhauls, has worked out at 10d per capacity seat-mile and £37 5s per aircraft flying hour.

The justification for offering air transport within the company is that it saves wear and tear on people and allows the maximum utilization of their talents. Apart from the strain of travelling by train or car and having to spend nights away from home, use of the Dove saves a great deal of time. For instance, Tatenhill to Chester takes 25min by air and 2hr 10min by car; to Speke, 25min against 2hr 30min by car; to Yeadon, 30min against 3hr by car; and to Cardiff 40min against 3½ to 4hr by car.

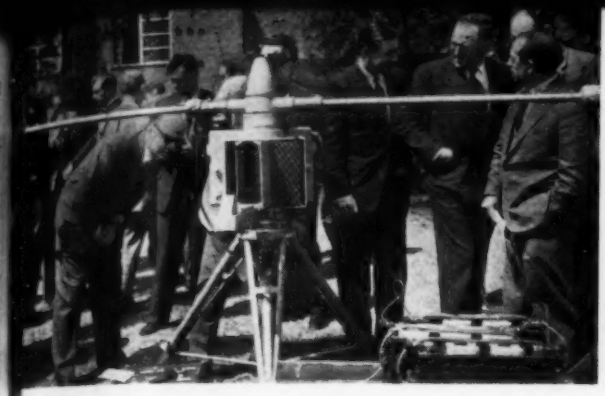
Ind Coope are not averse to allowing visiting aircraft to use Tatenhill, providing prior notice is telephoned to the airfield at Hoar Cross 283 and that the landing is "in the line of business." The company has its own bulk-store of 100-octane fuel, but cannot resell it.

THE DUKE OF EDINBURGH will visit Glamorgan Flying Club at Rhoose Airport tomorrow (June 2) to watch the end of the London - Cardiff Air Race. Competitors are expected to leave Panshanger between 4.15 and 4.30 p.m. and to arrive at Rhoose, 145 miles away, approximately one hour later. Entries will include a Turbulent entered by Prince Philip and flown by Wg Cdr John Severne, and a Spitfire 8 entered by Earl Mountbatten and flown by V. H. Bellamy of Hampshire Aeroplane Club.

THE £100,000 FUND set up by the Society of British Aircraft Constructors and Shell-Mex and BP Ltd to provide low-interest loans to flying and gliding clubs was established following recommendations from the Standing Joint Committee on Private and Club Flying and Gliding, and will be subscribed over a period of three years. This was stated in the Commons recently by the Minister of Aviation, Mr Thorneycroft, in reply to a question from Col C. F. H. Gough. At the end of the three years, he said, "the position will be reviewed in the light of the experience gained."

Would loans under the new trust be made available to British aircraft only or to foreign types as well, Col Gough asked. Mr Thorneycroft commented: "I should have thought that as the Society of British Aircraft Constructors is so prominent in the fund, there might be a certain disposition for British aircraft to have preference in this matter, although I understand that nothing of that kind is laid down."

Mr William P. Lear Sr taxies in at Geneva after his first flight in his company's executive/research Mustang. As reported in our issue of January 27, the machine's regular pilot is Mr William P. Lear Jr, director of Lear's European operations



Demonstration of the Fairchild Camera and Instrument Corporation Flight Analyzer at Cranfield. The equipment, used for making photographic records of the flight-path of aircraft and missiles, was described in these columns last week

FLIGHT SYSTEM SURVEY

Positive-lock Selector

Now being developed by Rotax is the positive-lock selector switch invented by Capt Hill of BOAC. The device is intended to form a positive, stage-by-stage gate for a flap lever or similar control so that the pilot can operate the lever without looking and be sure he will not overshoot successive gates. In addition, the lock operates in such a way during the retraction phase that the flap lever can be raised straight from the fully down to the maximum lift position, but cannot be inadvertently fully retracted. The ability to do this rapidly without looking at the lever and without risk of mistake is most important when going round again in large aircraft.

Many flap quadrants have gates, either on one side of the channel or in the form of kinked guide channels, but it is always possible, by applying slight sideways forces or during turbulence and vibration, to slip the lever past the gates. Capt Hill devised a system of pistons, one at each gate, linked by rocking beams in such a way that while one piston projects to form a positive barrier to the lever, the rocking linkage holds the next piston back out of the way. When the lever has been moved and is released, it shifts under spring load into its gate recess and at the same time presses the obstructing plunger back into its housing. The rocking linkage then causes the second plunger to emerge into the obstructing position. When the lever is again moved out of its gate and pulled further down the quadrant, it meets this second plunger and is positively stopped by it. Movement of the lever into the new gate then depresses the second plunger allowing the rocking linkage to move the third plunger out into the blocking position. If manufacturing tolerances are held reasonably closely, it is impossible for the lever to be moved more than one gate forward at a time.

For the return from the fully down setting which has no plunger of its own, the plungers have been so positioned by the downward sequence that the second one from the bottom is obstructing, allowing the lever to move past the intermediate setting, straight up to the maximum lift position. The control was originally devised as a four-position unit, with plungers located opposite the top three gates, but Rotax are developing a five-position unit for control of flaps in the up, 10°, 15°, 25° and 40° settings. The ARB have seen the device and support it, and manufacturers, including Shorts, have shown interest.

The movement of the lever into its gate depresses a microswitch which makes the electrical circuit for flap operation. The face panel is covered in Thorn Plasteck on which inscriptions are engraved and can be edge-lit at night. The unit will also be protected against damage from accidental spillage of tea or coffee in the cockpit.

Left, Mr P. Allaway, who becomes managing director of EMI Electronics Ltd on July 1, showing a circuit board from an Emidec 1100 computer to Mr Henry Hardman, permanent secretary of the Ministry of Aviation

Right, the positive-lock selector invented by Capt Hill of BOAC and now being developed as a flap control by Rotax. Note the locking plungers above the row of microswitches

American Award for Britain

THE American National Academy of Television Arts have presented jointly to Marconi's Wireless Telegraph, English Electric Valve Co and Radio Corporation of America their engineering award for 1961. The award was in recognition of the independent development of the image orthicon camera and pick-up tube, first as a laboratory tool by RCA in America and then as commercial equipment in Britain by Marconi and English Electric.

Development of the Mk III camera by Marconi, with English Electric making the pick-up tube, was begun in 1950 and proved commercially successful. A large number of these cameras were sold and the Mk IV, with numerous improvements, has now replaced it.

Precision Approach for Okecia

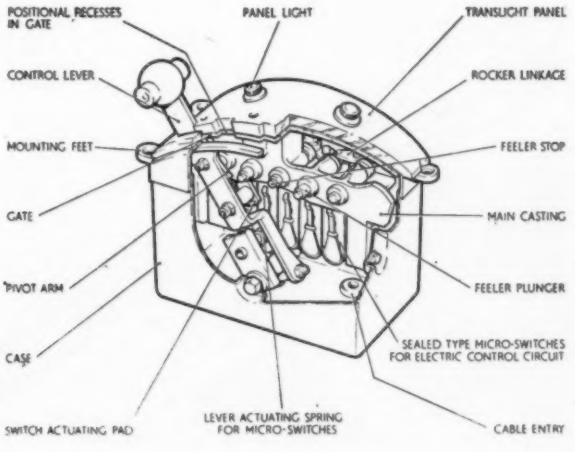
THE Polish government has placed an order with Pye Telecommunications Ltd for an ILS installation for Okecia, the international airport for Warsaw. This is reported to be the first ILS in Poland and will enable western airliners to make precision approaches at Warsaw. Some 133 Pye ILS systems are now installed all over the world, 13 of them in eastern Europe.

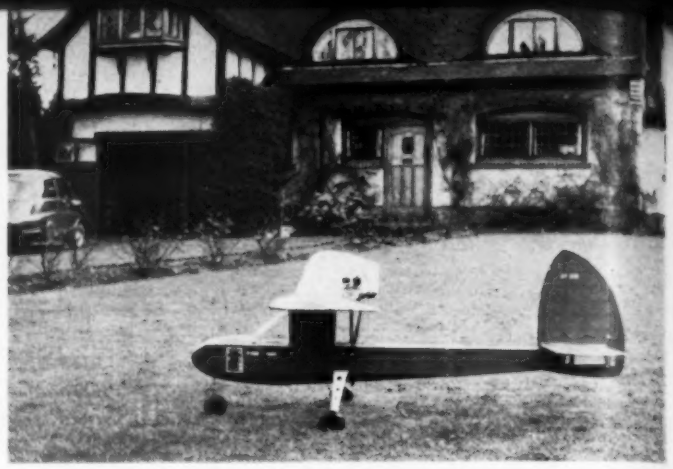
Radar Under ADR 160

THE RNAS at Yeovilton, which is situated directly underneath ADR 160 and south and north of airways Green 1 and Red 1, is to receive a Marconi S.264A/H high-powered, high coverage surveillance radar. Marconi equipment was chosen after extensive evaluation with small fighter aircraft. The installation will include five type SD.1020 fixed-coil displays and a video mapping unit.

Tape Punch and Read Standards

THE Data Processing Section of the Electronic Engineering Association has now issued a guide to the future requirements of paper tape readers and punches for use with data processing equipment. The guide contains a series of stipulations about the capability and general engineering features of tape punches with their associated error-checking systems. It has been submitted to the British Standards Institution and will be considered in due course as the basis for a British standard. Copies can be obtained from the technical secretary of the EEA, 11 Green Street, London W1.





C.1160

A Radio-controlled Scale Model

By Sqn Ldr J. Crampton, DFC, AFC, RAF (Ret)

THOUGH "Flight" ventures only seldom into the model-aircraft field, we think that this article well merits the space accorded to it. The author, who has served in RAF Training, Bomber, Transport and Fighter Commands and is now with a leading aircraft manufacturer, has based his "C.1160" on a pre-war ultra-light of a type he would like to see revived

WHEN, as a schoolboy in 1937, I saw a B.A.C. Drone I resolved that one day I would make a powered and radio-controlled model on similar lines. The Drone was a light aircraft with the engine mounted on the trailing edge of the wing centre-section and driving a pusher propeller. The engine and propeller on the model would be out of harm's way in the event of an accident, the radio could go in the cockpit and the batteries in the nose—and neither the radio nor batteries would be defiled by the engine exhaust. But it was not until 1960 that I actually started to build the machine and finally, early in 1961, the dream came true and the C.1160 left the ground—to return, I am happy to say, in good order and one piece. The only departure from the original, 1937, conception is the adoption of a tricycle undercarriage with nosewheel steering.

The fuselage, built around quarter-inch-square balsa longerons and covered with one-sixteenth-inch balsa sheet, is 5ft long and made in halves to simplify transportation problems. In the cockpit is a modified four-channel "Reptone" receiver and two actuators, one self-centering to operate the rudder and nosewheel (steering), and the other "progressive" to control the throttle of the Taplin Twin—a splendid 7 c.c. compression-ignition engine with two-in-line cylinders firing alternately. The batteries—in the nose—together with the radio and actuators are all readily accessible by removing the one-piece nose cowling and Perspex cockpit cover.

The wing has a span of 8ft and is constructed in three sections—two outer panels of 3ft and a 2ft centre-section which includes the half-inch-square spruce engine bearers. The outer wing panels are dowelled into the centre-section and additional support is provided by a simple strut to the lower longerons.

The tailplane is of symmetrical section with a 5° dihedral and 3ft span. No elevators are fitted at present, ascent and descent being governed by engine power. To overcome rotation and unstick problems during take-off the nosewheel is placed on a small three-wheel trolley prior to the take-off run, thus inclining the nose up about 6°. When the unstick speed has been reached the nosewheel "flies off" the trolley, which continues along the ground and is recovered later.

The engine, running on castor oil, paraffin and ether in equal parts, starts easily on a compression ratio of about 18:1. After start-up it is left to warm up at about 500 r.p.m. while a detailed check of all services is made. The chocks are then removed and the aircraft taxies slowly forward. The nosewheel steering system, still operative on the take-off trolley (which also rotates) enables one to manœuvre down-wind. A turn into wind is then made and the throttle is fully opened. This ground manœuvring thus constitutes a final and practical radio check.

It is a most impressive sight to see the comparatively large model—weighing about 8lb—gathering speed and finally leaving the ground and climbing slowly away with a plume of exhaust smoke streaming from beneath the fuselage (the exhaust is ducted straight down through the wing and fuselage). At maximum power the engine speed is 7,000 r.p.m. The propeller is of 14in diameter with an 8in pitch.

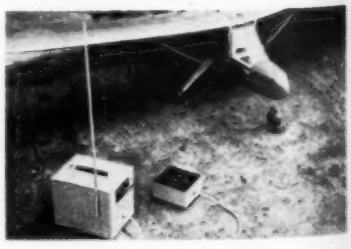
The approach is made at idling r.p.m. and the flare-out is achieved by inching the throttle open. At the end of the landing run the aircraft is turned and taxied back to base.

The E.D. transmitter with R.E.P. tone unit operates on 27 Mc/s, and has a safe ground-to-air range of about one mile. The remote hand-held control box is fitted with four potentiometers (to tune each channel) and a universally mounted control stick, fore-and-aft movement controlling the throttle and lateral movement the rudder and nosewheel.

This is indeed a splendid way to go flying and an ambitious development programme lies ahead, including some air-to-ground photography.

Right, pre-flight preparations with the aircraft on a convenient "base"

Left, how the power-plant, control receiver and batteries are accommodated



Right, the ground-control transmitter and its aerial

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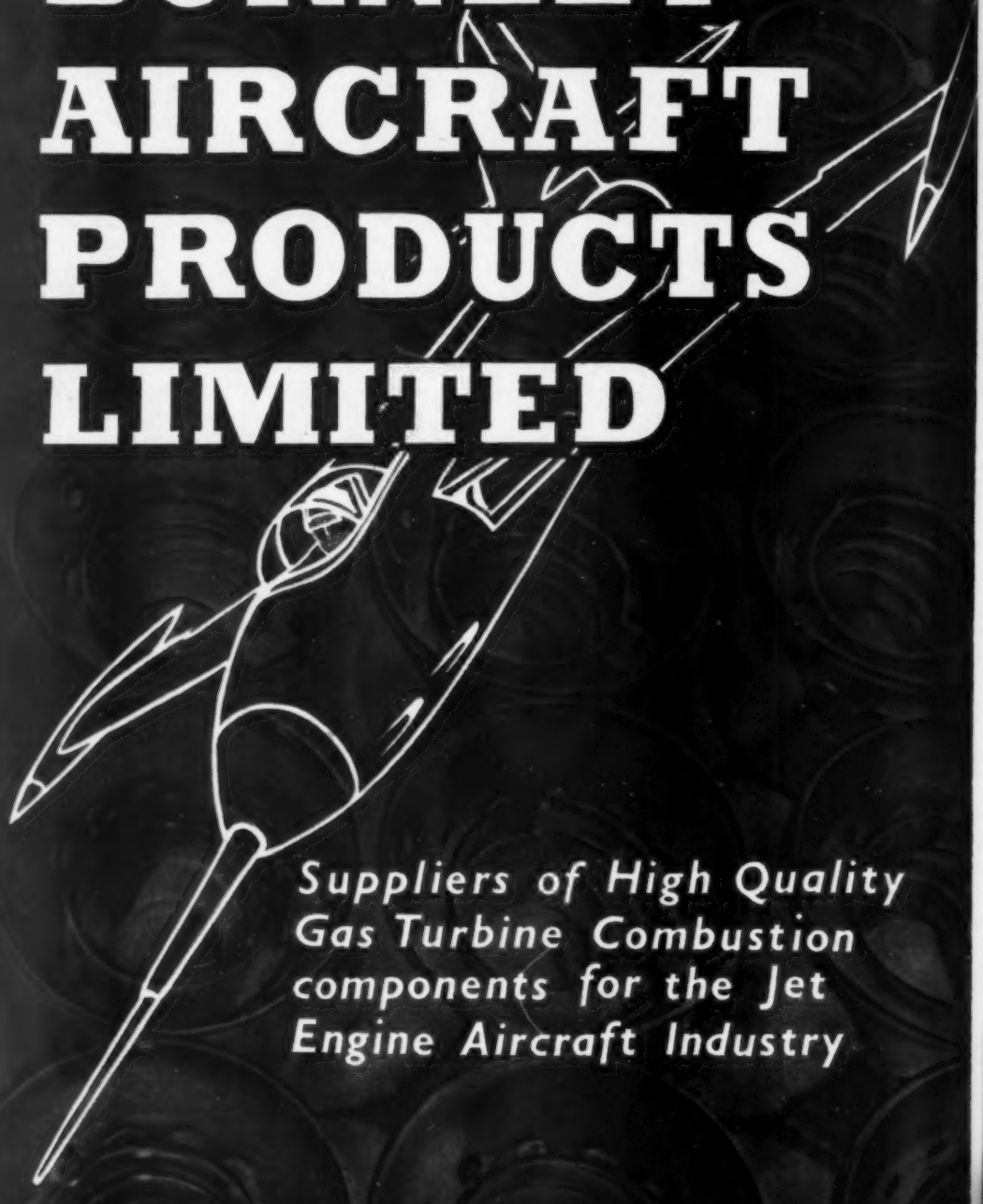

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Straight and Level

CONNOISSEURS of British air shows will return from the Paris aeronautical salon, as I have just done, with an odd collection of impressions. Is it a junket? Is the time and effort involved worth while?

All I can say is that if any British firm with designs on the world market wasn't there it should have been. Absentees are conspicuous at this show, the most competitive aviation trade occasion in the world.

On every stand, around every aeroplane, there is a market-place atmosphere of sell, sell, sell. People climb into aeroplanes and fly them. I don't know whether anyone actually sells anything, but as I contemplate foreigners in dark glasses earnestly discussing new products, I feel sure that the Paris Salon is to the British aircraft industry as the European Common Market is to Britain as a whole. We must be either in or out, not hovering indecisively over the middle of the Channel.

● *"I don't believe the public would suffer—and, after all, it's the public we are concerned with in [air transport]."* Mr Clive Hunting, president of the British Independent Air Transport Association.

Good gracious, pass me the sal volatile. I had almost forgotten this basic truth. Certainly Parliament did so when it passed the 1960 Civil Aviation Act. You can read that Act a million times, but nowhere will you find any care for the public interest. The object of the legislation was to "further the development of British civil aviation." Right up to the last minute the word "civil" was left out, then someone in the Ministry popped it in without reference to Parliament, realizing that British aviation includes the RAF, Fleet Air Arm and Association of British Spotters Clubs as well as the airlines. But the poor old public interest is left out; and everything that is done to "further the development of British aviation" is not done in the name of the public.

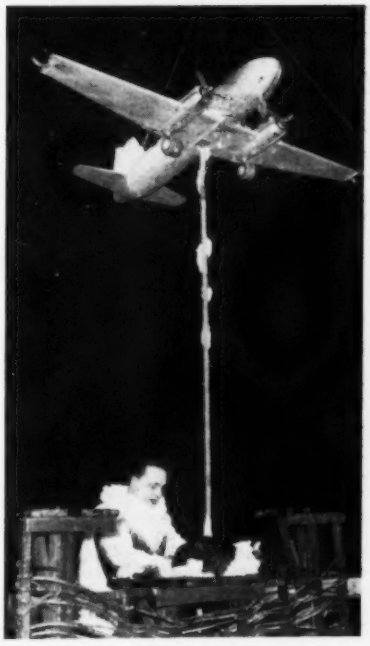
● At last BOAC and BEA are having to account to someone other than themselves for their pool agreements, and high time too. The Air Transport Licensing Board has recently been looking in to some of these secret revenue-sharing deals.

The corporations will not hesitate to brandish their pool agreements at any independent who bids for an international route. I think that pools are going to be the biggest single obstacle to independent progress—including foreign traffic rights, which pools buy off. So it is as well for the Board to know what pools are all about.

If I were an independent I would make an issue of state-airline pooling cartels blocking the way to private-airline enterprise and initiative. Not only would I thus be fulfilling the proper function of an independent, constructively challenging needling and testing everything the corporations do and the way they do it. I would also be attacking an obstacle to my progress, which is good business. Alas, I don't think the independents have thought very much along these lines, because both our leading ones, British United and Cunard Eagle, are themselves in pool with the corporations.

* * *

What I am afraid of is that the Board will give its blessing to pool agreements. It will find that pooling is a nice easy way of solving the delicate licensing problems that are now confronting it. Unfortunately, pooling would render completely meaningless all that has been spoken or written about the contribution that private enterprise can make to British air transport. Everything that is supposed to make air transport tick—competition, service to the public, widening of choice, price pioneering—all this is doubletalk in the context of a pool.

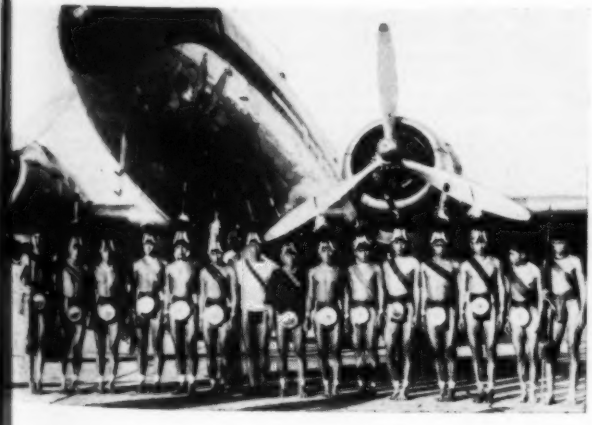


I wish the Russians would tell us more about their methods of obtaining quick turn-rounds in air transport operations. All I've had from them so far is this picture of whice mice embarking by rope in a model of an Il-14. In charge of ground handling is Vladimir Durov of the Moscow State Circus

Pooling makes airlines lazy. You can't lose if you are in pool so you don't need to try very hard. And even if there are incentive clauses, you spend more time watching your partner than you do concentrating on your own game. Moreover, there is always the possibility that one airline has to carry another, as I suspect BOAC are carrying South African Airways, Air-India and Qantas at the present time.

The poor old passenger meanwhile has to book about five years ahead if he wants an airline seat. Who will join me in a DOWN WITH POOLS banner-march to the offices of the Air Transport Licensing Board? Notices about the time and place of assembly will be published shortly.

ROGER BACON



I'm afraid I don't know what's going on here, but let me guess. It's the roll-out of a new aircraft designed and built by the Singaling Hkamti Aircraft Co of Burma, and with it are employees of the firm's tin - bashing department. The aircraft, needless to say, is intended as a DC-3 replacement

● *"Although RAF Thor training courses will be carried out in this country, crews will not be able to get actual flying experience here*—Reuter report.

AIR COMMERCE

May 19, 1961, was a historic day for the Handley Page Herald—the day on which it carried its first fare-paying passengers, as recounted in "Flight" last week. Jersey Airlines introduced services between Bournemouth and Jersey with two Series 100s leased from Handley Page pending delivery, due to start later this year, of their six Series 200 aircraft

Transatlantic Test Match: Cunard Eagle v. BOAC

WHEN Mr Harold Bamberg, chairman of Cunard Eagle, was called to give evidence at the Licensing Board's hearings into his North Atlantic application, it was a moment of some significance. After all, was he not the man who, more than any other independent, had caused the new Board to be brought into being? His application, A.1000, was the first to be lodged with the Board; and—more significant for those interested in the future rather than in the past—his application involved the world's most important route. As Mr Norman Ashton Hill for Cunard Eagle had said to the Board, in so many words, "If you can't permit dual participation on this route then you can't do it on any other." And as Mr Henry Fisher, QC, for BOAC had said, again in so many words, "If you can't refuse dual participation on this route then you can't refuse it on any other."

The Board was continuing its hearings into Cunard Eagle's application—opposed by BOAC—for a licence to operate across the North Atlantic. A first report on the proceedings appeared in last week's issue, page 723; this report goes to press as the case—extended beyond the provisional final day of Thursday, May 18—neared its end.

Mr Henry Fisher, for BOAC, spent a great deal of time challenging in detail the Cunard Eagle traffic facts and forecasts set out in Document A. The essence of this document—namely, that Cunard Eagle could operate this service without materially diverting traffic from BOAC—was explained last week. In cross-examination Mr Henry Fisher (whose formal case for the objector was still to come) set out to challenge Cunard Eagle's "central figure"—that North Atlantic traffic in 1962–65 would increase at an annual rate of 20 per cent. Mr Fisher quoted from an "accumulation of other forecasts," suggesting that the growth rate would not in fact be so high. References here—copies of which were supplied to the court—were the Port of New York Authority's forecast of December 1958; an ITA forecast of 1960; a Convair study of December 1958; a Boeing market research study of February 1959; and the ICAO forecast included in that organization's supersonic airliner study of August 1960. Mr Ashton Hill for Cunard Eagle quite effectively picked holes in these efforts to pick holes. Mr Fisher, accepting one of Mr Ashton Hill's counter-criticisms, said: "But I am putting this to you as an *accumulation* of evidence." "Yes," replied Mr Ashton Hill, "but accumulations of inaccuracies don't make you any more accurate."—"Mr Hill, you are turning into quite a wit."

Forecasts and Facts

Mr Fisher then criticized the fact the Cunard Eagle's forecast was based only on a four-year period, and he cited examples of unexpected events that can affect growth. (This criticism seemed, in retrospect, to vitiate a later BOAC claim that its own forecasts had proved to be within a half per cent of the actual achieved results.)

Mr Fisher went on to challenge Cunard Eagle's assumption that only 20 per cent of UK–US/Canada traffic would be taken up by other carriers—i.e., fifth-freedom carriers. Was it not the tendency, he asked, that the trend would be that more carriers would want to come in on this route? Was Mr Ashton Hill aware that Pakistan International Airlines were appearing on the route this month? Curiously enough, Mr Ashton Hill did not appear to be aware of this. Were there not other countries likely to press for rights? "Yes," replied Mr Ashton Hill, "and we suggest that there should be more British carriers, too." In any case, he said, more fifth-freedom carriers would not necessarily mean a change in the 20 per cent figure. Mr Ashton Hill, who had got off to a slow start—as might be expected of anyone pitched against so doughty an adversary as Mr Fisher—seemed to be getting the measure of his opponent. He protested against Mr Fisher's continual use of percentages instead of numbers.

On one Cunard Eagle assumption BOAC produced facts to show that the independent had been a little off the beam: Cunard Eagle's assumption was that BOAC would have a 40 per cent share of the traffic (based on 37-38 per cent in the past), whereas BOAC produced actuals to show that the shares were rather higher than those postulated by Cunard Eagle, including and excluding charters. Mr Fisher thought it "a fantastic suggestion" that Cunard Eagle's traffic was going to come out of other operators' shares, and not BOAC's. Did Mr Ashton Hill think other operators were going to stand by and watch their shares fall? "The assumption in this is that you are going to take from other people and not from BOAC—that is your case, is it not? You have postulated a considerable diversion from other operators, have you not?" Mr Ashton Hill said that Cunard Eagle did not have to satisfy the Board that they were not going to divert traffic from foreign carriers.

Traffic Rights

It has always seemed odd that traffic rights are not among those things that the Board has to take into account when considering an application for licence. This was one of *Flight's* main criticisms of the new legislation. We were therefore surprised and heartened to hear Professor Jack rule that BOAC could raise this matter for the Board's consideration. Technically, the next hour or so was out of order, because traffic rights are the prerogative of the Ministry of Aviation, and Professor Jack was overstepping his terms of reference. But the issues involved are inseparable from any discussion of a new international route.

What Mr Fisher was trying to do—though he was to be effectively answered by Cunard Eagle's Washington lawyer—was to show that the consequences of Cunard Eagle's appearance on the route might rebound upon the British. Mr Ashton Hill, he said, was no doubt familiar with the clause in the US–UK Bermuda agreement about "fair and equal opportunity" for operators of both countries. Would it not be unrealistic for the Board to assume that if UK carriers carried more than half the available traffic the US Government would take it lying down? Mr Hill replied that the phrase referred to equal opportunity, not to equal shares, and that UK operators had always carried less than half the available traffic. Was it not true, asked Mr Fisher, that Eagle had not yet started their tussles with the CAB, who were becoming, were they not, increasingly sensitive to the position of US carriers? Mr Hill said: "You are wrong if you think that the Americans have any power to exclude or restrict us." Cunard Eagle were not suggesting, hoped Mr Fisher, that there was imparity because there were two US carriers and only one UK carrier? They were not saying, were they, that because there were two US carriers there should be two United Kingdom carriers? Was it not possible that the consequences might be the addition of a third US or Canadian carrier? "But," asked Mr Hill, "is that any reason why we should not be designated?" "Mr Hill, I am only trying to show you the possible consequences of your licence being granted," was the reply.

Mr Fisher then raised the matter of BOAC's pool agreement with TCA. This was the first of what will surely be many occasions on which a corporation attempts to use a pool agreement to prevent the addition of a second British airline on a route. Mr Fisher had provided Cunard Eagle and the Board with a letter setting out the principles of the TCA pool agreement, noting that the Board "has

of course seen the full agreement." (The text of this letter appears on page 774.)

Mr Fisher did not follow through this pooling thrust, as that particular day's hearings were adjourned. He began the next day by stepping right into the controversial subject of Cunard Eagle's financial resources. As the cross-questioning went on, with Mr Fisher on professionally very firm ground, we thought how excellent a thing it is that independents' finances (a matter about which they have always been coy to the point of complete secrecy) should now be coming out into the open. The latest Eagle accounts available were dated December 31, 1959. Cunard Eagle's authorized capital at the time of the application was £100,000, of which only £100 had been issued. There were no fixed assets at all. "But there are now," said Mr Ashton Hill. There was also, noted Mr Fisher, a £3,000 loss on the profit-and-loss account, and the company had given undertakings to Martins Bank in respect of sums owing: about £600,000. Was that right and were there not other liabilities? "Not today," replied Mr Hill, "not since Cunard took us over." He said the accounts were misleading because they were not representative of the position today. Mr Fisher protested that he could not present the case on year-old information, and if they were misleading would they not also be misleading to the Board? "No," replied Mr Hill, "because the Board has a copy of the latest accounts." During this part of the cross-examination the significant fact emerged that Cunard Eagle are prepared to give to their jet navigators and flight engineers similar undertakings about pay that they will give to their pilots (see last week's issue). They had not yet considered whether they were prepared to give a similar undertaking to ground staff.

At this point a member of the Board, Mr Baldry, interjected with a protest that he could not find his way about the accounts—"they are too confused." But he thought it "rather undesirable" to talk in public about accounts of public concerns. The fact that Cunard's legally binding obligations to carry Eagle's liabilities covered the point, he thought. Mr Fisher suggested that it was not a legally binding obligation, and was one that existed only by virtue of shareholding. Mr Ashton Hill pointed out that Sir John Brocklebank—who had been present throughout—was a busy man and would not be there unless his company was fully prepared to take full responsibility for Cunard Eagle. If required, a legally binding undertaking could be given. Another Board member asked whether an import licence was held for the Boeing 707s. The answer was "yes."

Evidence from Cunard

Mr Harold Bamberg, chairman and managing director of Cunard Eagle, was then called to give evidence for the applicant. He explained that the application was framed to give "maximum commercial flexibility." The plan was to operate from London to New York at a daily frequency from May 1962. Later in the year, in October, Montreal or Toronto would be added as traffic points on certain New York services. What was contemplated was a routing such as London - Montreal - New York - London on one day, with New York and Montreal perhaps transposed on another day. As chairman he had "complete confidence in my organization to carry out the services for which we have applied. . . . As a director of Cunard Steamship Co I can confirm that the application has the complete support and confidence of that company."

Cunard Eagle's most vulnerable spot—the financing of the new *Queen* liner—was then exposed. Mr Bamberg was closely pressed on this account by Mr Fisher, and did not come out too well. "Why can't you find more than £12m," asked Mr Fisher, "for a new *Queen* if you can find £6m to buy Boeings?" Mr Bamberg said that it took about 25 years properly to amortize the ship. "It is very difficult to look ahead in the Atlantic market to that extent, whereas the Cunard board can look forward for a period of, say, ten years, and to that extent they are prepared to take the risk in obtaining a reasonable commercial return on a ship of this kind." When Mr Fisher asked why Cunard had gone to the Government and said that it could not find more than £12m of its own money and wanted £18m from the public purse, Mr Bamberg said he thought this question was one for Sir John Brocklebank. Mr Bamberg said that the question of a Government loan for the Q.3 and Cunard's activities in the air could not be related. Mr Fisher: "That is always being said. It is a sort of incantation. I am bound to put it to you, does it not cast doubt on your ability to finance this very large transatlantic air operation if you have not got enough resources without going to the Government for £18m for the replacement of your capital ship?" "The answer is categorically no," replied Mr Bamberg.

Sir John Brocklebank then took over. He said there was no inability to find more than £12m. It should be "unwillingness." The amount to be found was not the crucial point. It was the risk element, and the profit element, of any unit which had to last 25 years and cost £30m. Mr Fisher: "It would be a fair description of what you have just said, that Cunard had wanted to back both horses—the aircraft with their own money and the ship in part with other people's?"—"The ship problem came up long before we thought of buying Eagle, and we did not contemplate flying."

Mr Fisher: "It is a paradoxical situation that you should be accepting £18½m of Government money, at the same time planning to go into the air with your own resources, competing against public operators." "It is a way of putting it," said Sir John, adding that the maximum amount Cunard had got as a grant was £3½m; and when Mr Fisher asked him whether his company was "the chosen instrument" for British sea travel he said: "No, anybody can go across the Atlantic. There is no restriction like there is in the air." Sir John said he was not expecting to see sea travel across the Atlantic disappear, although it would go down and sea travel would be by fewer and better ships.

Washington Reactions

Cunard Eagle's Washington lawyer, Mr R. Beckman, answered BOAC points of which the implications were: (1) that the US would not grant an air carrier permit to Cunard Eagle if this meant diversion from US carriers; and (2) that the consequences would be the designation of a third US carrier. The evidence, said Mr Beckman, suggested a negative answer to both questions. In 22 years the President—who was the authority, and not the CAB—had never failed to grant nor had the CAB ever failed to recommend a foreign air carrier permit to a duly designated foreign carrier. He read out the CAB order in respect of the Cunard Eagle Bahamas application to serve points in Florida, an application which meant the addition of a second British carrier (the other being Bahamas Airways) on a route served by only one US airline, Mackey, who had protested. Among the extracts: "It is the view of this Government that it is obliged to admit multiple designation of UK carriers as laid out in the annexes to the Bermuda agreement, and that failure to do this would be an action in breach of that agreement." Mr Beckman said: "The US Government will not refuse to grant a foreign-carrier permit to Cunard Eagle for the North Atlantic."

As for the CAB's alleged efforts to restrict foreign carriers by calling for traffic data, these were entirely applicable to fifth- and sixth-freedom traffic, not to third- and fourth-freedom traffic. The CAB had no power to put capacity limitations on foreign carriers where there was a bilateral agreement of the Bermuda type and the CAB envisaged no such action. As for the implication that the consequences of the addition of Cunard Eagle might mean the addition of a third US carrier, there were no fears on this score.

Mr Fisher, who did not seriously challenge Mr Beckman's impressive evidence, asked Cunard Eagle's Washington lawyer whether he was not aware of the fact that the Bermuda agreement was being reconsidered. Mr Beckman replied that the route annexes to this agreement were under review, not the principles of multiple designation.

(*To be continued*)

Always an important day in the building of a new airliner is the rolling out of the first completed fuselage. In the case of the VC10 this event took place on May 7, when the fuselage of the first aircraft was moved from its jigs at Weybridge on a short-haul journey to an adjacent building for final assembly. Maiden flight of the first aircraft is scheduled for early next year

AIR COMMERCE...

Here, nearing the end of its flight test programme at Wisley, is the first of 14 Vanguard 953s for BEA. Delivery is imminent as this issue goes to press. First flight of the 953—which has a design payload of 37,000lb—was exactly a month ago

AUSTRALIA AND THE ONE-ELEVEN

BOTH Australian domestic operators, Ansett-ANA and TAA, have reacted favourably to the BAC-111 announcement. They would prefer the 107 for size, according to an Australian correspondent, but regard the Spey engine as an advantage.

Greatest advantage of all is the fact that the Department of Civil Aviation has been told by Vickers (but this has not been publicly stated, for some reason) that the 120lb/sq in maximum-weight tyre pressure can be changed to 87 in any aircraft sold to Australian operators. This pressure will allow the BAC-111 to operate into Essendon, Melbourne. The 107 would also be allowed into Essendon pending construction of the new jet airport at Tullamarine. The Department said this officially and has also wanted to put it on record that the Boeing 727 and the DH121 Trident would not be allowed into Essendon.

BAC has a great opportunity to sell the 111 hard against the Baby Caravelle, which is also causing a great deal of interest. The DCA will, it is thought, favour the operators buying the smaller jets first and to keep these operating for a year or two together with Electras. The DCA's opinion will be a major factor in these decisions. The operators could therefore have BAC 111s (or Baby Caravelles) operating in Australia in the second half of 1964—a wonderful opportunity for the British industry.

ABOUT AIR INTER

IN sharp contrast to the direct and increasing competition between BEA and British Railways, and to Aeroflot's declared aim of taking passenger traffic away from the Russian railways, French internal air services are run by a carrier which represents a noteworthy joint venture between State and private enterprise airlines on the one hand and French Railways (SNCF) on the other hand. This airline is Air Inter—Lignes Aériennes Intérieures, some details of which appeared in *Flight's* World Airline Survey of April 13, and whose *Bulletin d'Information No. 1*, recently issued, is a very creditable piece of public relations. It reveals that Air France and SNCF (Société Nationale des Chemins de Fer) each have a 24.95 per cent holding in Air Inter, the remainder of whose capital is held by UAT (7.27 per cent), TAI (7.27 per cent), Air Algérie (7 per cent), Aigle Azur (3.65 per cent), le Caisse des Dépôts et Consignations (4 per cent), le Banque de l'Indochine (5.27 per cent), le Banque de Paris et des Pays-Bas (5.27 per cent), Lazard Frères et Cie (5.27 per cent) and two road haulage concerns, Rapides de Lorraine and Rapides de Côte d'Azur, with a 5.1 per cent combined holding.

Air Inter started operations in March 1958 but discontinued services in November of that year because of rising costs. For the next year operations were on a seasonal basis, while commercial research was directed to the requirements—in particular co-ordination with surface transport—for a successful French internal network. Operations were resumed on June 1, 1960, and during the remainder of last year a total of 16,103 passengers and 81 tonnes of freight were carried, 1,333 hours were flown and a load factor of 49 per cent was achieved. Traffic was boosted by large-scale advertising (including the use of Radiodiffusion Française), by Air France's help as sales agents and by the opening of ticket offices on several SNCF stations for the sale of Air Inter and combined SNCF-Air Inter tickets. Price of the latter, which buys a first-class rail seat in one direction and a return journey by air, is now 10 per cent cheaper, apart from the reductions to which the passenger is entitled as a traveller by SNCF.

Paris-Toulouse, Paris-Pau and Lille-Lyons-Nice services were operated on a year-round basis during 1960, supplemented by seasonal services to Lourdes, Biarritz, Nice, Dinard, Quimper and La Baule. This year's operations have been greatly expanded, with the following new permanent routes: Paris-Lorient-Brest (from January 11), Paris-Lyons (from March 12), Paris-Nice (from April 1), Nantes-Lyons (connecting with the Lille-Lyons-Nice services), Paris-Clermont Ferrand-Nîmes and a route linking the south-west of France to Lyons and Alsace. The Paris-Toulouse route is now extended to Perpignan, and on most of the year-round routes weekday return fares are now 20 per cent cheaper. Group travel has also been made 10 per cent cheaper, although the group must now number at least 20 people instead of ten as before to qualify for group rates. Expansion of routes is being accompanied by an intensified sales drive carried out by the airlines and SNCF in close liaison. A ticket office has been open since January in the Champs-Elysées, and another will be opened later this year at 12 Rue de Castiglione, Air Inter's Paris office. Booking procedures will be simplified where possible, and Air Inter's operations could well develop in a few years to the stage where "walk-on" services similar to those of Allegheny—and more lately Eastern—become feasible.

Air Inter emphasizes that the use of leased equipment is only a temporary solution pending the acquisition of its own fleet; the company envisages a 20/25-passenger turboprop for secondary routes and a 40/50-passenger aeroplane for the main routes. A full-scale mock-up of the 50-passenger Breguet 942 in Air Inter colours has been prepared for the Paris Show.

AN AIRPORT FOR NORWICH

HORSHAM St FAITH is being considered by the Norwich Council as a new civil airport for East Anglia. An airport committee has been formed and letters have been sent to British airlines asking if they would be prepared to operate from the aerodrome if the council's airport committee takes it over.

It is upon the replies to these questionnaires that the decision to go ahead will depend, but it is hoped by developing the airport to encourage industry to take an interest in what is now largely an agricultural area. At present, Horsham St Faith is used by the RAF as a helicopter rescue centre but is virtually unused by fixed-wing aircraft. The council's plans are not proceeding without opposition, and there have already been complaints that civil aircraft would result in a noise nuisance. The airport is about 2½ miles north of the city, which has a population of some 118,000.

A new shot of Tupolev's turbofan Tu-124, Aeroflot's short-range Caravelle-class jet airliner. The aircraft was making its western début with an appearance at the Paris Salon this week

As recorded in a note on this page, the Duke of Edinburgh formally opened the College of Air Training at Hamble on May 19. He is seen about to fly one of the school's Apaches. With him is Capt J. W. G. James of BEA, chairman of the college's board of governors

DUCAL INAUGURATION

THE College of Air Training at Hamble was formally opened by the Duke of Edinburgh after a tour of inspection on May 19. After flying a Queen's Flight Whirlwind to Hamble, the Duke was received by the chairman of the board of governors, Capt J. W. G. James, and the principal, AVM E. C. Bates, then crossed over immediately to one of the College Piper Apaches and made a 30min flight with Wg Cdr G. C. Webb, the CFI. After this aerial inspection, he toured the briefing and lecture rooms, hospital and other facilities, inspected the new electronic flight procedure trainer supplied by General Precision Systems and formally declared the college open.

Speaking to the staff and the 41 students on the first course, which has been in session since last September, the Duke said that this was a great day for aviation and congratulated those responsible for the formation of the college—even if it should have been opened five years earlier. He said that, in addition to technical knowledge and skill, the students should be encouraged to develop those personal characteristics and qualities which made up good airmanship. At a time when everything possible was being done by machine, the man on the flight deck had to be able to apply those qualities which raised him above the level of machines. In contrast with other institutions, where courses in several different fields were run concurrently, the college students would tend to be isolated. Contact with other fields, and particularly with practising airline pilots, should be encouraged. The Duke concluded that, whoever won in the present conflict between the independents and the corporations, the College students would still be assured of their jobs. He then unveiled a commemorative plaque and was presented with a college tie by one of the students.

The ceremony was attended by Mr Peter Thorneycroft, Minister of Aviation, Sir Matthew Slattery, chairman of BOAC, and Mr Anthony Milward, chief executive of BEA, the last-named deputizing for Lord Douglas of Kirkteside, who was at the British Trade Fair in Moscow.

The GPS procedure trainer at Hamble is a fixed-base unit simulating the handling of a representative four-jet airliner with radio aids and navigation plotting tables. A fault panel mounted next to the co-pilot's or instructor's console can be detached and operated from the jump seat if two students are flying as crew. The first trainer is installed and another is to follow. The college fleet now consists of six Apaches and 11 Chipmunks, with three more Apaches and ten more Chipmunks to come. The Apaches are fitted with airline radio and have the trim controls relocated on a small console at floor level between the pilots. Standard trimmers are in the roof, but the new location has already proved very popular.

ITALIAN JETS THROUGH HONG KONG?

MR C. ANDO, Alitalia's regional manager for the Middle East and Far East, has said in Melbourne that when the company's own DC-8s are operating into Sydney next year he hopes that the route will be through Hong Kong and Bangkok rather than the Djakarta, Pnom Penh, Karachi route to be used by the first services from June. (The Alitalia service will begin with TAI DC-8s on charter, with Alitalia cabin service.)

Alitalia is very conscious of the tremendous growth in traffic between Japan-Hong Kong-Manila-Sydney. There is no direct Australia-Hong Kong-Europe service at present, but Swissair and Cathay Pacific join to sell all-through tickets at the same fare as the direct Sydney-London service. It is understood that Australia would not object to giving Alitalia rights for Sydney-Hong Kong, but the British attitude is not known. Alitalia will not, however, ask for Singapore at any stage.

NO FRYING TONITE

AMONG the problems of supersonic transport, as expressed by Mr Beverley Shenstone of BEA, are "how not to fry the passengers" and "how to prevent non-passengers from going deaf." The corporation's chief engineer was speaking on May 25 as guest of honour at the annual dinner of the Canadian Aeronautical Institute. Referring to IATA's recent supersonic symposium in Montreal he said: "The airlines did not call this symposium because they were mad keen to get into the supersonic transport business. It was indeed rather the opposite." He thought everybody would have agreed that there are more problems than solutions; in his own opinion, "the difficulties now seem greater than they were before the symposium took place, and I am rather glad that my own airline, being a short-haul airline, will not have any interest in supersonic airliners for many, many years to come."

At the moment it did not look as though Mach 3 aircraft could technically be available before 1975. Should airlines be thinking about this step now? Some said that there should *never* be supersonic transports but "the word never in aviation is a stupid word." Mr Shenstone noted that it took the aircraft industry 20 years to learn to fly three-and-a-half times as fast as the DC-3, and in that progression there were several steps. It was now being suggested that in 15 years we should, without intermediate steps, increase our speed three-and-a-half times, an increase not of 430 m.p.h. but of 1,500 m.p.h.

The likelihood of technical difficulties needed most careful consideration. "I think I can say clearly," he went on, "that every jet flying at more than 500 m.p.h. has had major teething troubles ranging from the disastrous to the merely expensive." Three major manufacturing firms had faced or were facing serious financial losses and a number of airlines had lost a great deal of money.

Mr Shenstone concluded his address by saying that the consequences of "pulling a fast one" might be the disappearance of some airlines or, alternatively, the forcing of others into combinations that could exert "complex and difficult travel restrictions of a type hitherto unknown." This could be a real danger to the public who would have to bear not only such restrictions but probably also higher fares resulting from the scramble.

INDIANS AND AMERICANS DISAGREE

TALKS between the Indians and the Americans about traffic rights have ended in breakdown. According to Mr B. R. Patel, Air-India's general manager, the US attitude has been "fantastic." He says the Americans refused "even to consider" Air-India's request for a daily 707 jet service from Bombay to New York starting in April 1962. Present 707 frequency is five flights per week; Pan American and TWA operate six weekly services through India.

The Americans are said to argue that Indian-originating traffic is insufficient to justify the increase in frequency. The Indians are, says Mr Patel, prepared to exchange for a daily 707 flight 10 or 14 "or whatever number of flights that US carriers want." He adds: "We are prepared to go further: we would depart from the principle of predetermination on which we have insisted so far. But we must have daily frequency from next year because we cannot stabilize Air-India's operations in the United States without that." (This probably means that they will not be able to keep their ends up in the BOAC-Qantas-Air-India pool.)

The civil aviation agreement between India and the US is one of the few "non-Bermuda-type" to which the Americans are a party. In other words, capacities of the carriers of each country are predetermined, and not related to the principles of "fair and equal opportunity" (see next note).

AND BERMUDA PRINCIPLES AT STAKE

SOME foreign airlines were criticized in Congressional testimony released on May 16 for using alleged "illegal and restrictive tactics" in competing with United States airlines. Mr Alan S. Boyd, chairman of the Civil Aeronautics Board, said that many countries were "very unhappy" about their air agreements with the United States, which were patterned after the Bermuda agreement concluded with Britain in 1947.

The principles of the Bermuda agreement were, he said, subject to serious criticism, "and it is questionable in our minds whether we can hold on to these principles."

AIR COMMERCE . . .

MEA MAKES A PROFIT

A FAMILIAR and melancholy theme of BOAC's annual reports is that the parent corporation made a profit, but that this was wiped out by the collective losses of BOAC Associated Companies. Not only Sheikh Najib Alamuddin but the British taxpayer can feel gratified at the announcement, shrewdly timed, of a profit of £25,000 in 1960 for Middle East Airlines, this figure being achieved after payment of all interest.

The profit was achieved despite the fact that MEA had to rely on its Viscounts to meet severe jet competition for virtually the whole year; delivery of Comet 4Cs did not start until December, and these aircraft did not become fully operational on MEA's routes until March. Between November 1, 1960, and March 31, 1961, the airline had been chartering Comet services from BOAC to provide jet capacity while their own Comet fleet was built up.

This was the second year in which MEA made a profit, the 1959 figure being £22,000, after heavy losses in previous years. Although the annual report is not yet available to make a full assessment of the airline's position, it is obvious that MEA is no longer "the sieve through which British taxpayers' money has been poured," as was alleged only two years ago.

An inter-party group of MPs left London for Beirut on May 18 by Middle East Airlines Comet 4C on a fact-finding visit to the Lebanon. From left to right: Mr F. W. Farey-Jones, Mr. G. R. Chetwynd, Mr C. Longbottom, Lord Balniel, Mr J. D. Cronin. A note on MEA's 1960 profit appears on this page

BEA's OBLIGATIONS

BEA's obligations to the public in the light of the recent Government White Paper "The Financial and Economic Obligations of the Nationalized Industries" were recently discussed by Lord Douglas. The White Paper specifies three main requirements that are to be placed upon the nationalized industries:—

(1) That revenue surpluses should be at least sufficient to cover deficits over a five-year period,

(2) That provision should be made for certain depreciation and contingency reserves,

(3) That each industry should be set a financial "target" for the next five years—a sort of five-year plan.

Lord Douglas points out, rather modestly, that BEA's achievement of a profit in each of the past seven years compares "very favourably" with other nationalized industries; and that although the nationalized industries are to have greater freedom in fixing prices—in particular raising them—BEA's policy is to continue to lower its prices.

BOAC's counsel in the Cunard Eagle North Atlantic case, Mr Henry Fisher, QC, has made the point that if the Board grants Cunard Eagle's application they will make it less likely that BOAC can carry out the policies laid down in the White Paper.

SEABOARD'S FREIGHT PORT

IN preparation for the CL-44, which Seaboard World Airlines are to introduce on to Atlantic services in July, the airline is transferring all its cargo handling activities to a new site on the south side of London Heathrow.

The new warehouse, which has a floor area of 18,000 sq ft, will come into operation this month and, divorced from the overcrowded aprons and limited space of London Airport North, should provide ample room to handle freight coming into the airport both by road and by air.

Considerable assistance has been given to Seaboard by HM Customs, who have had staff problems to overcome in manning freight sheds on both sides of the airport. This move, and the rearrangement of BOAC's warehousing and freighting arrangements on the north side, are likely precursors to a major reorganization of freight handling on the ground that could follow the revised IATA cargo rates.

Recently British United Airways demonstrated the practicability of inter-town charter flight by lifting one complete businessman from Coventry to Salford in their Westland Widgeon helicopter G-APPR. Flight time was 60 minutes: the idea was to demonstrate the time-saving compared with a scheduled fixed-wing flight plus surface travel

TRUTH ABOUT POOLING

FOR the first time someone other than a pool partner has been allowed to have a look at a pool agreement. In evidence before the Air Transport Licensing Board last week BOAC said that a copy of their agreement with TCA had been given to the Board—though in confidence. Meanwhile, the broad principles had been set out in a letter to Cunard Eagle.

Since any crumb of information about pools is always hungrily seized, we print it in full. Though it is only a crumb, it puts this pool in a differing perspective from that of the original release (*Flight*, December 4, 1959), which spoke only of "benefits to the public." This aspect comes last in the statement now released; this clearly shows the pool to be more a move by BOAC and TCA to form a bloc against competitors (which they have always denied). The statement made public at the Board's hearing of the Cunard Eagle North Atlantic case read as follows:

"Put very shortly, the basic principles of the pool agreement with TCA are that both parties will provide equal capacity and will share revenue 50/50. As a result, BOAC and TCA are no longer in competition with each other for the revenue obtainable on the route. They can and do agree together to provide services at times most convenient to the travelling public, instead of competing with each other for the best days and times of operation. Their schedules and frequencies are agreed so as to provide an integrated pattern of services. The parties are therefore free to compete more effectively with foreign carriers which have in the past diverted Canadian originating traffic through the United States to the United Kingdom and Europe.

"The foregoing is clearly reflected in Clause 1 of the agreement, dated 30 November 1959, constituting the pool operation in which the objectives of the parties are set out in the following terms:—

'The objective of this agreement is to effect an improvement in the financial results of each party hereto.

'In broad terms the aim of this agreement is the combination of two Commonwealth carriers against foreign carriers in order to provide for the public the best service between Canada and the UK and beyond in both directions.

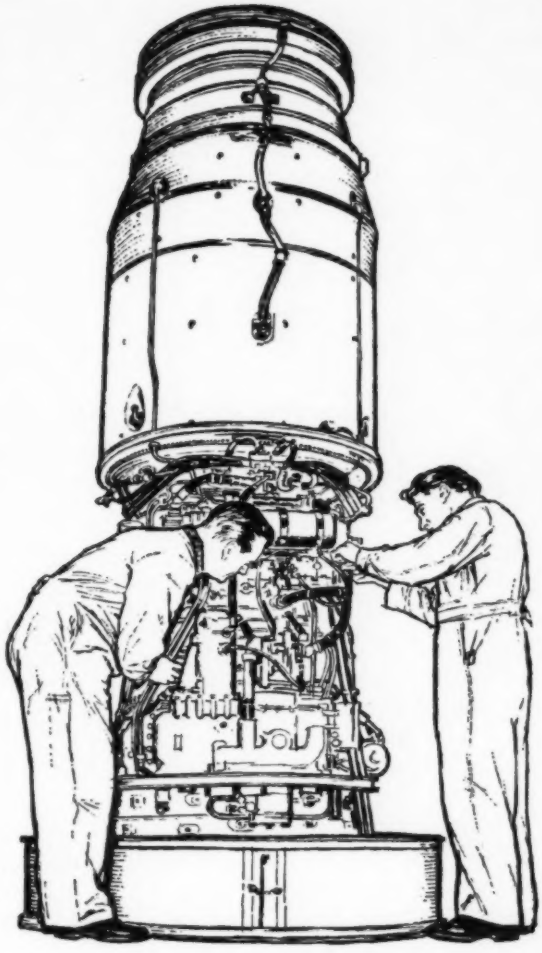
'Both parties are aware that at the present time the inroads of European and American carriers into traffic which should be available to the carriers of Canada and the UK are increasingly serious and arise from three principal causes: (i) Diversion of Canadian originating traffic through USA to Europe; (ii) European carriers' direct attack on the Canadian market; (iii) European carriers' inroads into the UK market.

'In the process of combining against such competitions, the parties would present a joint and united selling appeal to the market, would integrate operations to offer a better service to the public in terms of frequency of outlets and would enjoy some savings from the exchange of handling and other services.'

"The detailed provisions of the Agreement are designed to enable the parties to achieve these objectives."

BS
AERO POWER

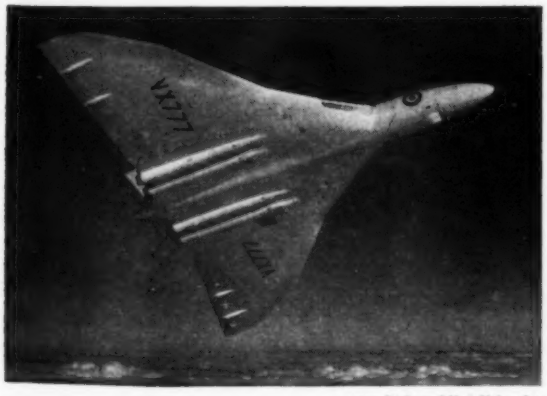
Olympus—for supersonic economy at Mach 2 plus



An advanced version of the Bristol Siddeley Olympus is now under intensive development for British Aircraft Corporation's TSR 2. It will give this unique tactical/support reconnaissance aircraft an exceptional performance at speeds up to Mach 2 and over.

THE RIGHT QUALITIES . . .

The Olympus has the ideal thermodynamic cycle for the economic propulsion of a supersonic aircraft at Mach 2 plus and embodies all the qualities essential for such an application: high power at high altitude; extremely low fuel consumption; great operational flexibility; a long overhaul life; a very high thrust/weight ratio; and excellent handling qualities.

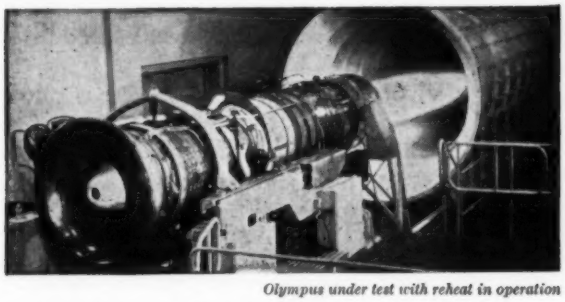


Avro Vulcan Mk 2 V-bomber

. . . PROVED IN SERVICE

The Olympus has proved itself in several years' service, as the powerplant of the Avro Vulcan V-bomber, to be one of the most successful turbojets ever built. Maintenance is exceptionally low—last year, for example, on a 26,000-mile round-the-world tour, the maintenance required was negligible.

The truly astonishing built-in potential of the Olympus has been confirmed by the threefold increase in power from the 11,000-lb thrust dry of the original production engine, to the 33,000-lb thrust with reheat of the latest version.



Olympus under test with reheat in operation

SUITABILITY FOR SUPERSONIC AIRLINERS

Already selected for the RAF's most up-to-date supersonic aircraft, the Olympus will clearly require relatively minor changes to adapt it to the requirements of a supersonic airliner in the same speed category.

BRISTOL SIDDELEY ENGINES LIMITED

TURBOJETS–TURBOFANS–TURBOPROPS–RAMJETS–ROCKET ENGINES–MARINE AND INDUSTRIAL GAS TURBINES
MARINE, RAIL AND INDUSTRIAL DIESEL ENGINES–PISTON ENGINES–PRECISION ENGINEERING PRODUCTS

ready for take-off!

The first production "Santa Maria" is now ready for take-off, at your service—this is not just "another" lightplane . . . it is made to order for the man who needs a *working* airplane. From propeller spinner to rudder, the "Santa Maria" is all muscle and bone—no delicate gadgets—no chrome. Its great load carrying capacity comes at no cost in performance; and it's not a prototype, but a fully developed aircraft, already in quantity production and FAA certificated.

Useful load 1,500lb — practical range (with reserves) 550 miles with a 940lb payload — take-off distance to 50ft. 1,050ft — full 500 ft/min climb at 17,000ft altitude.

AERMACCHI - LOCKHEED SANTA MARIA

Information on delivery dates from the Sales Manager, Aeronautica Macchi S.p.A., via Sanvito Silvestro 80, Varese, Italy

AIR COMMERCE...

Illustrated for the first time in these pages is a DC-8 in the colours of Panair do Brasil, who recently took delivery of their first aircraft (two Series 30s are operated). The picture was taken just before a recent departure from Paris for Buenos Aires

HOW GROWS IT?

JUST published by BEA in advance of its full annual report (due to appear later in the summer) are the essential facts about traffic in the financial year 1960-61. On the financial side, as recorded in *Flight* for May 18, page 679, a provisional net profit of "at least £1¼m" was achieved. This was less than the £2m of 1959-60, due largely—as may be seen from the table—to a decline in load factor. This fell overall by the slightly higher figure of 2.5 percentage points. The vital statistics are that total load ton-miles went up by 19 per cent, and the number of passengers carried nudged the four million mark—the highest of any airline outside the USA.

The Ministry of Aviation has meanwhile published figures for the month and year ending February 1961 for British scheduled air transport as a whole—corporations plus independents (who are still described as the corporations' "associates"). Load ton-miles in the year ending February 1961 went up to nearly 500m, an increase of more than 21 per cent. Load factor dropped from 61 per cent to 59.1 per cent. BOAC's western-routes load factor slipped to below the 50 per cent mark, to 49.3 per cent, a drop of nearly four points on the corresponding previous 12 months, whilst BOAC's eastern-routes load factor was boosted from 61.8 per cent in the year ending February 1960 to 64.1 per cent in the year under review. BOAC's western-routes capacity went up by no less than 43 per cent in the 12 months under review, compared with less than 12 per cent on eastern routes.

There are no signs of depression in independent scheduled activities, and inclusive tours particularly put on a healthy 26.3 per cent growth, nearly 200,000 passengers availing themselves of independent-operated package holidays during the 12 months under review.

The total number of scheduled passengers carried by British operators in the year ending February 1961 was very nearly six million, actually 5,990,353. Of these, as already recorded, nearly four million were carried by BEA. The independents carried 1.29m scheduled passengers, and BOAC 770,000.

BEA 1960-61

	Year ended March 31, 1961	Year ended March 31, 1960	Variation
Capacity ton-miles offered	237,396,000	191,992,000	23.6%
Load ton-miles sold ...	154,772,000	130,032,000	19.0%
Revenue load factor ...	65.2%	67.7%	2.5 points
Passengers carried	3,990,957	3,289,606	21.3%
Passenger-miles flown ...	1,393,364,000	1,153,785,000	20.8%
Passenger load factor ...	66.7%	69.4%	2.7 points
Freight ton-miles	16,601,000	14,894,000	11.5%
Mail ton-miles	4,215,000	4,001,000	5.3%
Aircraft miles flown ...	40,151,000	37,366,000	7.5%
Revenue hours flown ...	195,725	193,790	1.0%

JOINING CHANNEL AIR BRIDGE

MR ALASTAIR PUGH has joined Channel Air Bridge as project and development manager, his appointment taking effect on May 23. Aged 32, Mr Pugh was educated at Johannesburg and Tettenhall College, Staffs, and was trained at the de Havilland Aeronautical Technical School, concentrating on aircraft design and obtaining his private pilot's licence. For three years he was a member of the design staff of H. M. Hobson of Wolverhampton. Since June 1956 he has been a member of *Flight's* editorial staff, specializing in air transport and technical articles, including flight-test assessments of new private and business aircraft and hovercraft.

BREVITIES

Mr William Whelan, formerly district manager, London, for Aer Lingus, has been appointed the airline's administrative manager, Britain.

It is now thought that the Japan Air Lines DC-8 that overran the runway at Tokyo on April 24 is damaged beyond repair.

According to *Interavia*, SAS has sold six DC-7Cs to GALCO, a Convair subsidiary, at a price of about Skr25m (about £1.7m). SAS will continue to operate the aircraft until the end of the summer.

IATA announce that in the first quarter of 1961 North Atlantic passenger traffic went up by 28.8 per cent. The 18 airlines concerned carried 293,675 passengers. Load factor, however, was 49.8 per cent—seven percentage points down on the first quarter of 1960.

American Airlines have supported Pan American's motion to the CAB that foreign countries should file with the Board copies of their pooling agreements. American say that pooling is closely aligned with traffic data (for which the CAB has also called) and should therefore be included.

The Minister of Aviation, Mr Peter Thorneycroft, has appointed Lord Balfour of Inchrye, MC, TD, to the Board of BEA for a further period of three years from July 1. He has also reappointed Lord Tweedsmuir, OBE, LL.D, as a part-time member of the Board of BOAC for a period of three years to June 5, 1964.

President Kennedy has granted BOAC a foreign air carrier permit, as recommended by the CAB, for the operation of Route 3 in the UK-US Bermuda agreement. In effect this enables BOAC to extend its services from the UK to New York and beyond to the Bahamas, Cuba, Panama, Colombia, Ecuador and Santiago.

The technical committee of the British Air Line Pilots Association has elected Capt R. I. Hill as chairman in succession to Capt M. W. Broom, who is elected joint vice-chairman with Capt L. Taylor. Capt Hill is a BEA captain based at Renfrew.

Yesterday, May 31, Canadian Pacific was inaugurating DC-8 services with a flight from Vancouver to Amsterdam and Rome via Edmonton. Today, June 1, a return trip will be operated between Vancouver and Montreal via Winnipeg and Toronto.

According to *Aviation Daily*, Boeing have designated a new short-range jet transport weighing less than 100,000lb Boeing 737. It will have three tail-mounted turbofans and is intended for "routes now being served with Martin and Convair equipment."

East African Airways have declared a profit for 1960, after payment of interest, of £460,683 on an operating revenue of £4.34m. Col M. C. P. Mostert, general manager, refers to EAA's Comets as the "most popular and reliable aircraft on all the routes." Passengers carried by the airline increased by 14.6 per cent to nearly 150,000.

Today, June 1, the Air Transport Licensing Board will hold its 13th public meeting, when applications for inclusive tours from Air Safaris (Manchester - Copenhagen) and from Falcon Airways (Gatwick and Malaga/Tangier) will be heard. The meeting begins at 2.30 p.m. The next public meeting will be held on June 6, when the Board will hear British United's application to operate a scheduled service to the Canary Islands; one from Silver City to operate services from Manston or Lydd to Birmingham, Manchester, Liverpool and Blackpool (Starways objecting); and another from East Anglian to operate scheduled services from Ipswich and Portsmouth to the Channel Islands (Silver City objecting).

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Enlightened Attitude

IN today's [April 27] issue of *Flight* I noticed your article "ICAO Shares Experience," in which you both support the effort of dispelling the taboo of public discussion of air safety matters and the commonsensical idea of sharing aircraft accident experience.

This article, as well as your leaders "In the Cause of Safety" of March 16 and "Safety and Secrecy" of March 30, prompt me to congratulate you on your enlightened attitude. I must say that my own experience in this field has been the happiest and most gratifying with the airlines, aircraft manufacturers and research workers in all European countries, including Great Britain. This experience is the ground for my conviction that your efforts will prove successful.

London SE14 B. R. STANOJLOVIC,
European Representative, Daniel and Florence Guggenheim Aviation Safety Center

Phugoid's Ancestry

From Prof P. J. Yangos

IT is very well for Mr Norman Wells (Correspondence, April 27) to make fun over the word "phugoid," but try to put it back into Greek, as the writer has to do once a year when lecturing in the Royal Hellenic Air Force Academy, and then you will find blank looks all over the classroom.

Fortunately, since 1949, Sir Graham Sutton (*The Science of Flight*) came to my rescue: "... This odd-looking word was coined by Lanchester from φυγή and εἶδος, literally flight-like, but this was a 'howler'; φυγή implies flight only in the sense of being a fugitive and not as a bird. Despite this, the word has survived in the literature of aerodynamics, possibly because it is short and easy to pronounce." What would Mr Norman Wells have to say, had posterity appreciated in a greater extent "... Lanchester's inordinate love of words coined from Greek roots such as 'apteroid,' 'peripteroid,' 'pterygoid,' 'ichthyoid,' etc.?" ... (isoclinic or anisoclinic alike).

Sir Graham's explanation of the word "phugoid" is shared by Theodore von Kármán (*Aerodynamics, Selected Topics in the Light of their Historical Development*), who, going a step further, remarks: "my Greek would suggest 'phygoid,' but I am not quite sure about the term." I venture to say that *I* am and it should be phygoid, if anything like it (BSI please note!).

Still, there is worse, such as "anhedral" or "cathedral," or even "aerobatics," which, quite rightly, the Americans turned into "acrobatics." "The Greeks had a word" for many a thing, but beware of using this ancient language where they did not.

Athens P. J. YANGOS

The Princess Flying-boats

AS you will be aware, the final date for submitting offers for the Princess flying-boats was extended from March 31 to June 30, and my Group have accordingly been advised by the concerned authority of all details and conditions appertaining to the sale. As far as I am aware we are the only organization in existence with any concrete and firm proposals for the commercial utilization of these fine aircraft. We are not scrap merchants and therefore do not intend to compete in the purchase of the hulls and ancillary equipment unless we have complete confidence in the Ministry of Aviation and the new Air Licensing Board that we stand a 100 per cent chance of an unrestricted high-density route.

We are observing with keen interest the battle between Cunard and BOAC, the outcome of which in its long and protracted form, together with the probably long-delayed decision by the Board, will undoubtedly ring the final death-knell of the Princesses. I doubt very much whether Mr Thorneycroft would wish to have his name associated with the death warrant of these superb aircraft and to have the dissipation of vast amounts of public money associated with the present Administration.

It is only too obvious that national prestige in the sixties and seventies and the far-foreseeable future will be associated directly with a nation's authority in the air. BOAC cannot be too proud of its record, considering the huge financial resources and effort which has been lavished on the undertaking. The "Queen" liners may have been the symbol of national prestige in the thirties but a new Cunarder will certainly not retrieve our lost and dwindling commercial aviation authority.

In 1958 I wrote to the chairman of Cunard making firm and positive suggestions with regard to the operation of the Princess flying-boats under the Cunard flag. I also put proposals to Mr Bamberg of Eagle Airways and it was indeed a disappointment to this Group that in both cases we received no support or encouragement. Cunard are the obvious organization, in our view, to have operated the Princess flying-boats on the North Atlantic route.

The suggested governmental assistance of £18,000,000 could well be expended on the Princess flying-boats. In point of fact, the Princesses, by our careful investigation, could be put into full flying trim for under £4,000,000. One of the chief designers, Mr J. C. Stevenson, who recently joined our staff, has made an independent appraisal of the installation; and the consensus of opinion is that the Princesses, far from being obsolete, would with the new Tyne 12 be a phenomenal commercial success. It should be borne in mind that the Princesses would in fact be "flying Vanguards," and the long and extensive flying trials of the Vanguard reflect favourably and with benefit on the Princess project. The British flag would carry far more prestige-value on the tail of the Princesses than flying from the mizen of a new Cunarder, no matter how large.

Southampton BENNETT G. HALPIN
Managing Director, British Princess Flying Boats Ltd.

Out to Grass

IN a recent letter to *The Times*, dealing with the problem of preserving historic aircraft, Mr Charles Gibbs-Smith mentioned the possibility of the grounds of country houses being used to store some of these types.

This letter coincided with the handing-over of the last Sunderland at Pembroke Dock, by the French Navy, to our Short Sunderland Trust. Even before the "Save-the-Sunderland" campaign was completed, I had given much thought to other types not yet saved, and had in mind making use of the ten acres of property here as an aircraft museum.

In London this week I shall be following up my investigations as to whether I can implement the idea. Provided I get half the co-operation shown in the Sunderland project, I have little doubt that the plan can succeed.

Pantgwyn Mansion, PETER F. M. THOMAS
Cardigan

Gas-turbine Lubricants

THE first "In Brief" paragraph in "The Industry" section of your issue for May 11 refers to the grant of DEng RD2487 approval for Castrol 98 and goes on to say this is the first and only British oil so approved. By inference, Esso Aviation Turbo Oil 35 is made out to be of foreign origin. The facts are that EATO 35 is wholly British, from inception through development to final approval way back in 1953. This work was done at Abingdon by Esso European Laboratories, now Esso Research Ltd.

There is an American counterpart, Esso Turbo Oil 35 (without the "Aviation") which was evolved by Esso in the US and is essentially identical with EATO 35. However, I know the British company is very proud of its pioneering activity in this field.

Reigate, Surrey N. O. RAWLINSON

Aslib's Aero Group

ROUND about boat-race time in the spring of 1952, a party of trepidatious people gathered at Cranfield for the first time. They have done so at about the same time every year ever since—except in 1961. They could, I suppose, be described as the aeronautics hindermost room boys (and girls), since they are the Aeronautical Group of the Association of Special Libraries and Information Bureaux.

Shortly after the end of the war, Cyril Cleverdon, librarian of the College of Aeronautics, felt there was a need for greater co-operation between librarians of the various aeronautical firms, the Ministry (it has changed its name so often that I will not be more specific) and other bodies with the common subject. At first he made little headway; but then Aslib decided to form specialist subject groups and a further effort to bind the aero libraries was made.

With co-operation from the Royal Aircraft Establishment through the then Director, Arnold (now Sir Arnold) Hall, and his information officer, Bob Thorne, a meeting was called at RAE in September 1951, a committee was formed, a programme outlined and the Aero Group was launched—or should one say airborne?

The group has set itself several tasks down the years but always in the forefront has been the desire to collect all the information on its subject and then make it available. Not only has it aimed to make it available but to do so in the shortest possible time. To do this last, the perennial subject has been "retrieval." A library may have every piece of information on a subject that has ever been published, but if a particular item of information is not "findable" at the precise moment that it is required, one might just as well burn the library. Rumour hath it that when the USSR launched its first Sputnik the USA went haywire trying to ascertain the wavelength on which it was transmitting. It was not until long after that it was discovered that the Russians had published the information and that the Americans had it all the time.

It is, of course, almost impossible to index completely the whole of human knowledge, and librarians and others spend many hours discussing systems of classification using numbers, words, letters, holes-round-cards, magnetic clues and what have you. The Aero Group has done its best to try the likely ones that are compatible with a library budget and one of its achievements was to gain a grant, through Aslib, from the National Science Foundation for the investigation of three systems of retrieval. Cleverdon has been supervising the research over the past two years with a team of three, working against stop-watches.

One of the group's first achievements was its instrumentality in forming a section of Agard to study documentation. Another was the compilation of a *Union List of Periodicals*. This listed the journals held by each member of the group. By consulting it, one can obtain the loan of any one of some hundreds of periodicals and thousands of reports by return of post. It is a great pity that the man-hours thus saved for the industry (for you must remember that the man requiring the document is also helped) cannot be calculated.

The group has never ceased to emphasize the importance to industry of an efficient information service. Adequate is not a strong enough word. In many cases firms have been woefully slow to recognize the benefits of having a department where days and months of research can be saved by a preliminary search of the available information.

Thanks to the good relations born of the annual conferences, every member firm will co-operate, the Ministry will co-operate, the fringe bodies will co-operate.

I said at the beginning that 1961 was the exception to the boat-race date. This year the *tenth* annual conference will be held during the weekend from Thursday, July 13. It is hoped that the conference will be a particularly good one and the group will take the opportunity to take stock of the past decade. It is fitting that the chairman for the year should be Cyril Cleverdon. The conference is not limited to members either of the group or of Aslib. Anybody who is interested in the dissemination of information generally and its connection with aeronautics (and aerospace) in particular is very welcome. All information is obtainable from Mr C. W. Cleverdon, Librarian, College of Aeronautics, Cranfield, Bletchley, Bucks.

As a matter of interest, from the first meeting when a committee was formed in 1951, four members are still on the committee. They are Cleverdon, Alan Cameron of Avro, A. H. Holloway (then of the Ministry and now of the Admiralty) and

London W1 FRANK SMITH

FORTHCOMING EVENTS

June	2	RAeS Rotorcraft Section: "Development of Stabilizing Equipment for Helicopters," by P. D. MacMahon.
June	15	RN Air Station Lee-on-Solent At Home.
June	17	RN Air Station Yeovilton At Home.
June	17	US Armed Forces Day: Open Day at USAF Bases.
June	17	RAeS Rotorcraft Section: Helicopter Rally and Garden Party, Dunsborough Park, Ripley, Surrey.
June	17	Opening of Bedfordshire Air Centre, Cranfield.
June	17-18	West Aero Club of France: Wines, Flowers and Chateaux of Anjou Rally, Angers.
June	18	Aosta Rally.
June	24	RN Air Station Arbroath at Home.
June	24	Bristol Air Day.

THE INDUSTRY

Smiths' Russian Order

WHAT is described as "the first Russian order for aircraft flight instruments of Western manufacture" has been placed with Smiths Aircraft Instruments Ltd by the Russian foreign trading organization V. O. Avtoexport of Moscow. It is for forty-five Kelvin Hughes KAA-1603 altimeters, to be installed in Aeroflot aircraft operating on Western European routes. These altimeters show altitude in feet and barometric settings in millibars and will be fitted in addition to existing Russian altimeters.

Reinforcing Radomes

SOME details have been given of the use of double-curvature woven-glass reinforcement made by Fothergill & Harvey Ltd, Harvester House, Peter Street, Manchester 2, for radomes on English Electric Lightnings. Two advantages claimed are close tolerances and a satisfactory dielectric constant.

The company state that the English Electric reinforced plastics division, after trial-and-error research employing conventional lay-up methods, fabricated prototype radomes using three-dimensional woven shapes. These proved completely satisfactory and were chosen for production Lightnings. Tolerances for completed radomes were plus or minus 0.004in, and adherence to such fine limits was extremely important if the dielectric constant was to be maintained at all points on the shape.

The three-dimensional weaving process, for reproducing exactly a predetermined shape in cloth without seams or irregularities, is operated under exclusive licence in the UK by Fothergill & Harvey.

Newly appointed by the Sperry Gyroscope Co Ltd: Mr Robert Hess (left), president of the Wright Machinery Co of Durham, NC, a division of Sperry Rand Corporation, now managing director of the London company in place of Mr Robert Broadbent, who remains on the board of directors; and Mr J. D. Stevenson, manager, aero sales, in succession to Mr C. A. Richardson, who has gone to Sperry Europe Continental to take up an appointment as director of export sales

Lt Cdr J. G. P. Morton, test pilot at the Fairey Aviation division of Westland Aircraft at White Waltham, being presented with a Fairey Rotodyne model by Mr Norman Thorogood of Revell (Gt Britain) Ltd, well known for their scale-model kits

IN BRIEF

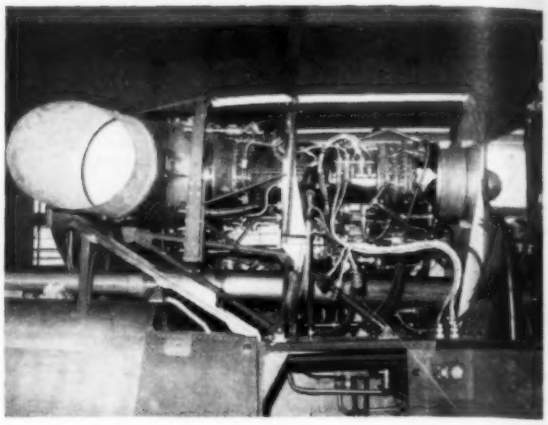
Mr C. M. Vignoles, CBE, managing director of Shell-Mex and BP Ltd since 1951, retired at the end of last month. Aged 60, he has been with the Shell group since 1924. His successor as managing director is Mr J. E. H. Davies, a general manager of the British Petroleum Co Ltd since 1956.

Castrol Ltd have appointed four new assistant managing directors, Messrs J. A. V. Watson, L. G. Packham, C. E. R. Millidge and A. A. Barr. Their appointments take effect from January 1 next year. Aviation will be one of Mr Watson's particular interests. He became general manager, motor and aviation sales, in 1948 and four years later was elected to the Castrol board.

Five executive directors have been appointed by Goodmans Industries Ltd. Mr J. B. W. Dawkins becomes director and general manager; Mr L. J. Swift, director of vibrator division; Mr P. K. Cuthbert, works director; Mr C. Smith, director of production development; and Mr P. D. Collings-Wells, director of acoustic development.

Marconi's Wireless Telegraph Co Ltd announce that Mr F. S. Mockford has relinquished his appointment as commercial manager to undertake special duties for the managing director. Mr F. Wheeler becomes commercial manager and Mr H. Baker deputy commercial manager.

Mr Peter J. Garrini, until recently sales consultant, Vernon's Industries Ltd, Liverpool, has formed a new company, Peter J. Garrini and Associates Ltd, 120 High Street, Edgware, Middx (Edgware 3008). The object of the company is to act as overseas sales consultants for British companies who are interested in export markets but have no personal representatives covering the territories concerned.



EXPORT GNOME FLIES

IT was on December 21 last that the de Havilland Engine Co announced the first export order for Gnome turboshaft engines. A contract worth almost £1m was signed with CA Giovanni Agusta, of Milan, for engines to power the Agusta 204B. In addition, an option was taken on a "very much greater quantity" of Gnomes, for delivery during the next three years. This was a major victory for the team from Leavesden, for not only was foreign competition intense but the 204B is essentially a Bell HU-1A Iroquois, which in the United States has a different type of powerplant.

On May 10, after only 25min ground running, Sig Ottorino Lancia, Agusta's chief test pilot, took the first 204B into the air. Well over 2½hr had been flown by May 16, and most of the critical parts of the flight envelope—including autorotation, vertical climbs, hovering and high-speed level flight—have already been explored. The aircraft has now been painted, and is scheduled to fly at the Paris Salon, described in an earlier section of this issue (pages 734–743). The close-up of the installation shows well the exhaust trunk, taken out to starboard, and the tail-rotor drive from the secondary gearbox under the rotor.

FIRST DOUBLE ATLANTIC CROSSING

(continued from page 749)

repair. It was accidentally declutched whilst under load and the governor failed to control it. The captain then felt compelled to set course for East Fortune, but his plan was countermanded by Air Ministry, who ordered him to Pulham. The Irish coast, a little to the north of where Alcock and Brown had landed in their Vickers Vimy, was crossed at 2000hr on July 12, 1919, exactly 61hr 43min after leaving Long Island. The landing at Pulham was made after an elapsed time of 75hr 03min.

The flying crew of R 34 were years ahead of their time. They had operated W/T with Clifden both ways at more than 2,000 miles. They had experimented with pressure-pattern flying. The navigator had foreseen the use of bubble sextants in the air.

Heavier-than-air Crossings Of the other flights shown on the chart on pages 748-749 there is little to say that has not already been said.

The first crossing, by the American NC-4 flying-boat, was a magnificent achievement. No matter that they took three weeks over the trip, that crew was the first to cross by air; and when I revisited the Mayflower steps at Plymouth recently I was glad to see the well-kept plaque which rests in the wall beside the Mayflower Stone and reads:—

This tablet was erected by the Plymouth Borough Council to commemorate the arrival, on the 31st day of May 1919, of the American seaplane NC4, in Plymouth Sound, on the completion of the first transatlantic flight, and the reception by the Mayor of Plymouth of the Commander, Pilots and Crew, on their landing at the Barbican.

J. P. Brown Mayor. *R. J. Fittall Town Clerk.*

Lt Comm A. C. Read USN (Commander)
Lt (Junior Grade) W. Hinton USN (Pilot)
Ensign A. C. Rood (Radio operator)
Lt E. F. Stone (Pilot)
Lt J. L. Breeze USN (Res Force)
Ch. Machinist E. S. Rhodes USN.

Mackenzie-Grieve and Hawker had a very gallant try and were incredibly fortunate to find a ship in sight when they decided to ditch their Sopwith biplane. They were even luckier that the weather was so calm at the time that their aircraft did not break up when it hit the water. They had entered for the £10,000 prize offered by the *Daily Mail* for the first non-stop crossing and no one grudged them the £5,000 consolation prize they received.

Pride of place among the aeroplanes must, of course, go to the Vickers Vimy (Rolls-Royce Eagles) flown by Alcock and Brown. At 0840 on June 15, 1919, the first direct non-stop crossing was made—16hr 27min of concentrated history.

COMANCHE ROUND FRANCE

(continued from page 755)

weather is clear. We track round the zone from the free lane, again using London VOR. Then thick mist appears and we struggle through the Reading gap. The Comanche's small windows make map-reading pretty difficult under these conditions so I abandon the ground, climb up and fly out on the London radial which lies between Abingdon and Kidlington. The German girl suddenly points at the spasmodically moving control wheel—the autopilot is on—and asks "what is that?" I shall always treasure this as the classic question from a first-flighter. Having established myself on the London radial I tune Upper Heyford and then turn onto the radial that passes through Kidlington. Then I let down into the murk, with visibility of less than a mile. I recognize nothing until the Upper Heyford runways loom up. A smart turn onto the reciprocal and I fly the left/right needle like an ILS localizer. Up comes Smoky Joe, the Kidlington factory chimney, and then the airfield. From downwind I cannot see the landing run and follow the taxyway round onto finals. We land in visibility which would have kept me extremely firmly on the ground, but with VOR there was not a moment's anxiety or uncertainty. This is proof of the pudding. Normally, I reckon I can find my way by map-reading as well as most people, but why work so hard when you can fly in smooth air, VFR on top, and navigate by radio? Final refuelling shows a consumption of 8.2 Imp gal/hr after Paris, using moderate power at medium altitudes and making three separate flights.

It is sad to leave the Comanche. It was comfortable and smooth, fast and easy to fly. My passengers loved it. I am totally converted to the use of autopilot and VOR, even though I was previously inclined to think them "cissy." This has completely vindicated the American way of airborne life and I do not look forward to going back to the Gemini. Comanche visibility ought to be better and its handling is not perfect, but comfort and utility make up for almost anything. Wake up, Europe!

JET CHRONOLOGY

NOTING with pleasure the transference of the Gloster-Whittle E.28/39 to the new block of the Science Museum (picture in *Flight* May 18), Sir Frank Whittle reminds us that the duration of the first flight was seventeen minutes, and not seven minutes as was stated in our quotation of a makers' press release. Sir Frank suggests also that our younger readers might assume from the caption "OFF GROUND AGAIN after twenty years" that the historic aircraft did not fly after 1941. It was, in fact, flying with various powerplants until 1944. The Heinkel 178, incidentally, first flew in 1939 and not 1940 as suggested in our leading article.

SERVICE AVIATION

Air Force, Naval and Army Flying News

RAAF Changes

THIS week has seen announced changes in the RAAF higher command take effect, with Air Marshal Sir Frederick Scherger vacating the Chief of Air Staff post to become Chairman of the Joint Chiefs of Staff. From last Monday, he was succeeded as CAS by Air Marshal (promoted from AVM) V. E. Hancock, whose former position as AOC Operational Command has now been filled by AVM (formerly Air Cdre) F. Headlam.

Royal Flush VI

THERE was a very close finish to this year's Allied Air Forces Central Europe reconnaissance competition, 2nd ATAF beating 4th ATAF (as briefly reported in *Flight* last week) by 9,970 to 9,807 points. This was 2nd ATAF's fourth victory. Last year, the contest was won by 4th ATAF.

In the long-range day missions, Canberras of No 17 Sqn beat RB-66s of the USAF by 2,254 points against 1,942; but in the long-range night missions, for the first time in the six years the contest has been held, there was a tie: both No 31 Sqn (Canberras) and the 10th Tactical Reconnaissance Wing Team from Alconbury (RB-66s) scored 1,101 points. The third RAF team, flying Hunter FR.10s, was beaten in the short-range section by the French Air Force team which scored 2,354 points as against 2,226. The French also won the medium-range missions. Targets in Italy and Germany and as far afield as Denmark, southern France and Scotland were photographed, some of them 450 miles away from the Belgian Air Force base at Beauvechain where the competition was held. Flight-planning had to be done in 40min and only one run was allowed over the target.

Whitsun Displays

LIKE the start of flat racing and the beginning of grouse-shooting, Whit Monday has come to mean the start of the United Kingdom air display season. Traditionally now the Royal Air Forces Association, which organizes big events on this day at North Weald and Hucknall, and the Soldiers', Sailors' and Airmen's Families Association, with its annual show at Yeadon, set the ball rolling for the season which ends with the Battle of Britain "at homes" in September. This year, as far as weather was concerned, the south was luckier than the north: clear skies and sunshine predominated, while over the northern area there was a layer of stratus all through the day at about 3,500ft, with only brief clearances and intermittent sunshine. This meant that No 92 Sqn were somewhat restricted, at any rate at Hucknall and Yeadon, on their first public appearances in the UK. Nevertheless these royal blue Hunters showed the same adaptability to conditions as their predecessors Treble-One Sqn, and the nine-man team put on a "flat pattern" show at Hucknall and Yeadon, so that their performance was at all times visible to the 30/40,000 spectators. The aircraft even performed their final bomb-burst horizontally, from a low-level run-in.

It seems as though the 92 Sqn team has earned itself the nickname "The Blue Diamonds," coined by a German newspaper as "The Black Arrows" was coined by a French newspaper for Treble-One. "Blue Diamonds" was used by the squadron's commentator, Flt Lt Vickery, and in the absence of any better ideas may well become permanent. "The Falcons" has been considered as a title but does not appear to have met with general favour.

Diamond in a summer sky: 92 Sqn at North Weald (see "Whitsun Displays," this page)

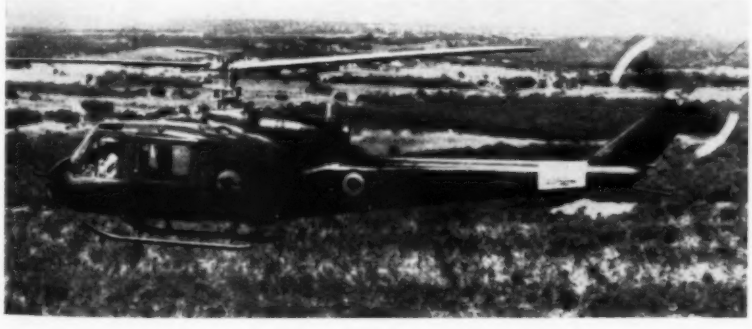
At the Whit Monday displays the squadron was led by its CO, Sqn Ldr Brian Mercer, and gave an impeccable performance of nine-, seven- and five-aircraft manœuvres.

The Hunters' colouring—blue with white wingtips—is attractive, their use of smoke (from the very beginning of the display) impressive. On Whit Monday they had a busy day, flying from their base at Middleton St George near Darlington to Wattisham, thence to North Weald for the first of the day's shows. From there they went to Waddington to refuel, before performing at Hucknall and Yeadon.

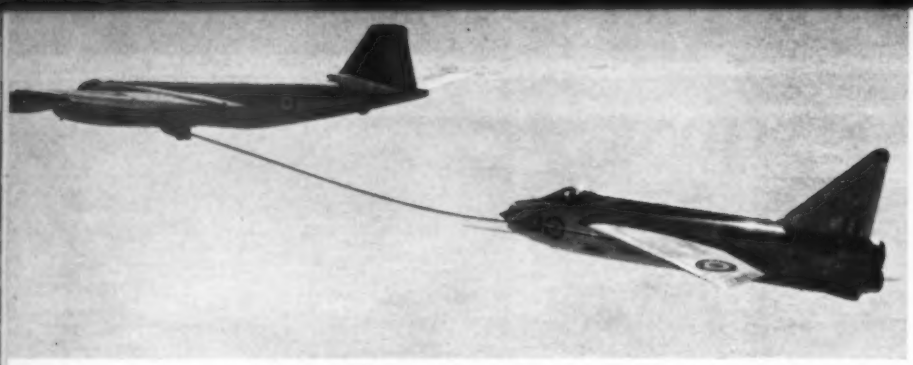
Like 92 Sqn, several of the day's "acts" appeared at all three displays, notably the international aerobatic champion Francis Liardon in his yellow Bucker Jungmeister. His performance was a masterly exhibition of daring and skill, aided by the infallible inverted-flying qualities of his aircraft. Flick rolls, bunts, semi-inverted circuits, slow and nine-point rolls followed with almost automatic ease, each manœuvre being completed with precision. This was an admirable and attractive show in every way. At Hucknall, there was some equally splendid display flying from Baron de Serigny of the Paris Flying Group at Panshanger in his Tiger Moth with its orange wings and black fuselage: this was crazy flying at its best, a real Whit Monday entertainment.

Both Hucknall and North Weald were fortunate in having visits from the Hurricane and Spitfire flown respectively by Bill Bedford and David Morgan. Though these aircraft look slower year by year, their agility and beauty of line is impressive and so long as the Battle of Britain is remembered they will be viewed with affection. North Weald was lucky in having the CFS Jet Provost team, which has been re-formed this year under the leadership of Flt Lt R. Brambley in the same four-man configuration as in 1960 and clearly is upholding the same high standards. A pleasing feature at Hucknall was

Red Indian in Australia: one of the Bell Iroquois Hu-1B helicopters with which No 9 (Search and Rescue) Sqn, RAAF, is being equipped



Wg Cdr H. A. England, RAF task force commander of the 2nd ATAF team at the Royal Flush VI reconnaissance competition (see above), receiving the Gruenther Trophy from Prince Albert of Liège at Beauvechain



English Electric hook-up, between a Canberra and a Lightning F.1, during in-flight refuelling trials from the company's aerodrome at Warton in Lancashire

SERVICE AVIATION . . .

beautifully synchronised aerobatics by two Chipmunks of Nottingham UAS (Sqn Ldr Horth, the CO, and Flt Lt Law), Cambridge UAS putting on a similar show at North Weald and Flt Lt Cameron of Leeds UAS performing at Yeadon. The USAF made their contribution to the day's events with a refuelling demonstration and a C-130. At Hucknall the KB-50J tanker and F-100, F-101 and B-66 were all present and correct; at North Weald the Sabre was missing, and the formation had to cry off visiting Yeadon because of low cloud. But in general all the flying went according to plan, and about a million members of the public had an entertaining afternoon, benefiting the charities which so ably organize these excellent displays.

Replacing NZ Sunderlands

WITH ample opportunity in recent months for studying the Neptune and Hercules at first hand, in their use by the USAF from New Zealand for Antarctic operations, it looks as though the NZ Government may consider buying these types for the RNZAF. Recently the Minister of Defence, the Hon D. J. Eyre, intimated that five Hercules and "eight or nine" Neptunes would be required for the Air Force for long-range transport and maritime reconnaissance duties. It is suggested in Parliamentary circles (writes a correspondent) that this tentative decision has been influenced by Australia's policy of equipping with American aircraft. Commenting on the switch from flying-boats to land-based machines—the Martin Marlin was considered, but production has ceased—he comments that this will mean writing-off the Lauthala Bay flying-boat base in Fiji, development of which is reckoned to have cost £3m.

Duxford's Farewell

FAMOUS as the oldest of Fighter Command's airfields (dating from the First World War), Duxford is to close as an active flying station on August 1. It has several claims to fame in addition to longevity. The first Spitfires were based there (with 19 and 66 Sqns, in 1938); the winner and third man home in the 1959 *Daily Mail* London-Paris race, Sqn Ldr C. G. Maughan and Gp Capt E. N. Ryder, both came from Duxford: the former, CO of No 65 Sqn, and the latter (now retired) the station commander; both 65 and 64 Sqns received their standards there at a joint ceremony last July; and it was at Duxford in 1924 that Wg Cdr A. W. (now Marshal of the RAF Lord) Tedder commanded No 2 Flying Training School before it moved north to Digby. One of his flight commanders was Flt Lt F. J. Fogarty, now Air Chief Marshal Sir Francis Fogarty and Air Council Member for Personnel before he retired from the RAF in 1957. All officers who have commanded the station have been invited to a farewell ball on July 14. Duxford's present CO is Gp Capt A. L. Winskill, CBE, DFC.

Leading the Field

WITH an almost continuous history for the past 46 years it was about time No 12 Sqn found a chronicler and Fg Off Tim Mason has commendably stepped into the breach. His *Leads the Field** (a title borrowed from the squadron motto, which it acquired with Fairey Foxes in 1926) records "Shiny Twelve's" doings from its formation at Netheravon in 1915 to its present existence at Coningsby with Canberras. In all these years there has only been a break of some eight months—July 1922 to April 1923—so No 12 can well claim to be a distinguished veteran among bomber squadrons, especially as two of its members, Fg Off Garland and Sgt Gray, won the first air VCs early in the Second World War. During the war the unit operated Wellingtons and Lancasters: then from 1946 to March 1952, when the first Canberras came, it had Lincolns.

* Available to ex-members from No 12 (B) Sqn, RAF Coningsby, Lincs, price 12s 6d post paid; and to others from Beaumont Aviation Literature, 2a Ridge Avenue, Winchmore Hill, London N21, price 17s 6d (18s 6d post paid).

Meeting the Hittites

AN incident which befell the crew of a Twin Pioneer in the northern hills of Oman has been recounted in the current Air Ministry newsletter. Fg Off A. J. S. James and his navigator M/Nav H. J. Gladwyn of No 152 Sqn, based at Bahrain, were flying over desolate Shihu country looking for a suitable airstrip when they spotted a likely-looking area inside a volcanic bowl. After a touch-and-go Fg Off James landed and as soon as the engines stopped the aircraft was surrounded by scores of natives, some of them carrying steel hatchets. One man, evidently the chief, spat angrily at the Twin Pioneer; another, who spoke a little Arabic (the natives were remnants of the ancient race of Hittites), said the chief believed the aircraft would stop the rain coming. Fg Off James started to pace out a strip prior to take-off but the tribe gathered menacingly round him and he had to return to the Twin Pioneer, being struck on the arm with the flat of the chief's hatchet as he boarded it. When the starboard engine was started, the Hittites scattered and the aircraft managed to take off. Five days later, Fg Off James flew over the area again. The Hittite chief need not have worried: the entire valley was flooded.

IN BRIEF

Sqn Ldr Fern Villeneuve, leader of the RCAF "Golden Hawks" aerobatic team, is to receive the AFC for skill, courage and determination in force-landing his Sabre [*Flight*, November 18, 1960] instead of ejecting; so that the aircraft would not come down on the town of Newcastle, New Brunswick.

The RAF Benevolent Fund is to benefit from the United Services Bath searchlight tattoo being held at Bath from July 26 to 29 in the evenings, with a matinée on July 29.

No 49 Sqn are hoping to write a squadron history and would be grateful for any relevant information, which should be sent to the Adjutant, No 49 Sqn, RAF Wittering, Peterborough, Northants. They state that they "guarantee to return any photographs, log books or other personal possessions after we have had photostat copies made."

In a written reply the Air Minister, Mr Julian Amery, stated that 17 flying accidents in 1960 caused the deaths of 44 members of the RAF. Causes of eight of the accidents had been established, probable causes of four were suspected but could not be confirmed, and in a further four cases the causes were unknown. One accident was still being studied.

Some of the RN aircraft making their first appearance in the Paris Show flying displays (on June 3 and 4) will be operating from HMS *Hermes* in the English Channel. A Sea Vixen and a Scimitar are making a simulated nuclear attack on Le Bourget airfield; and as a finale, four Scimitars, three Sea Vixens and four Gannets are flying past in formation. All these aircraft are to take off from and return to the carrier.

A Sycamore of 225 Sqn in a recent exercise with the City of London Battn, Royal Fusiliers (TA). The squadron, based at Odiham, is now engaged in full-time training with infantry units in the use of helicopters in the assault role

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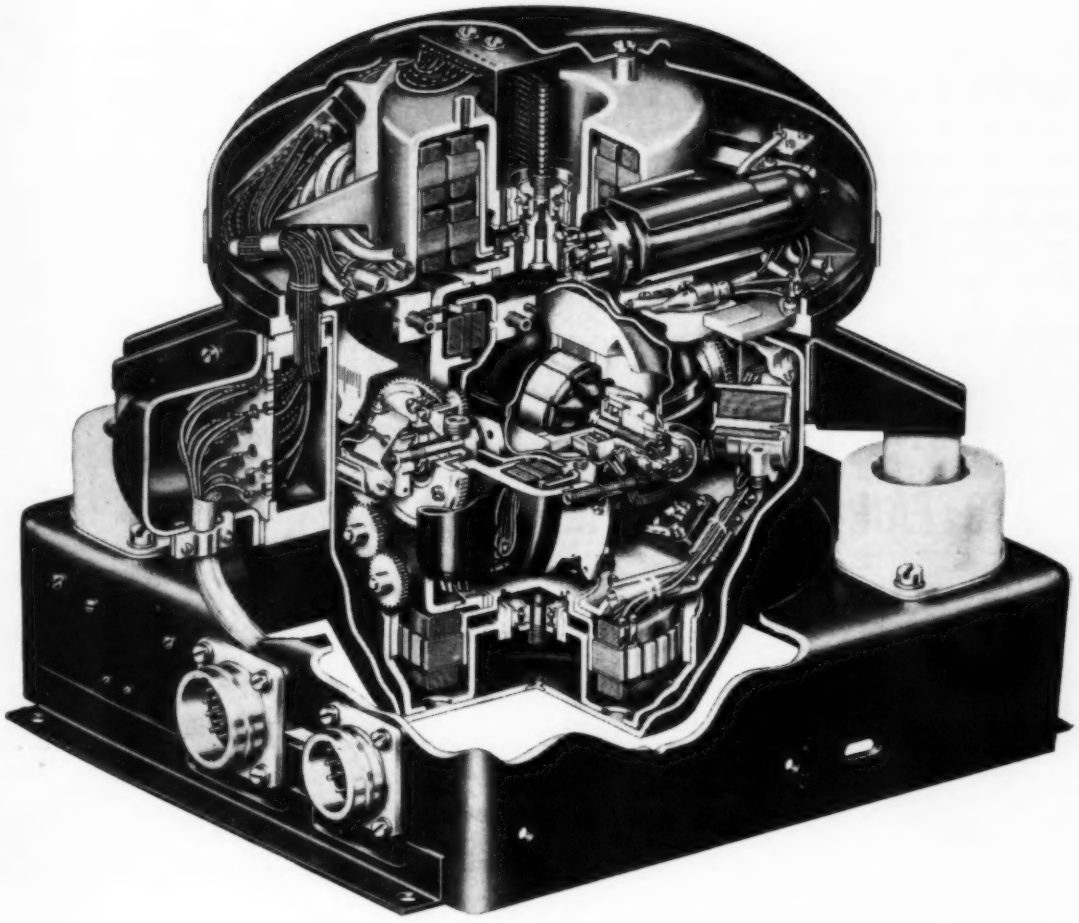

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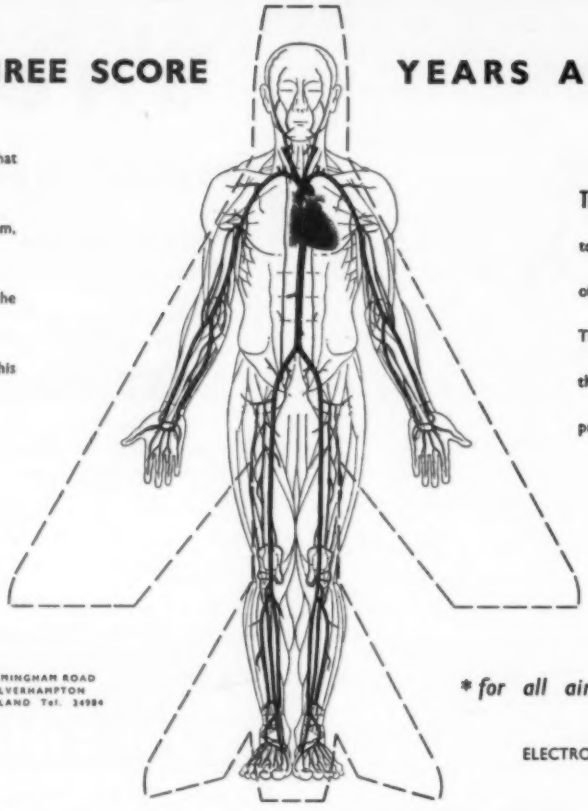

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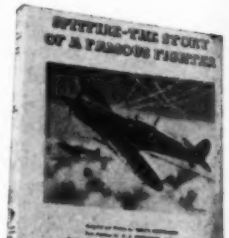

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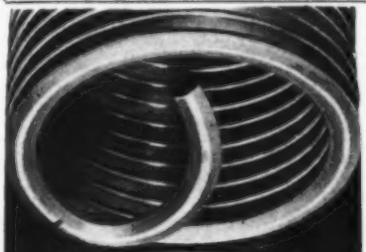

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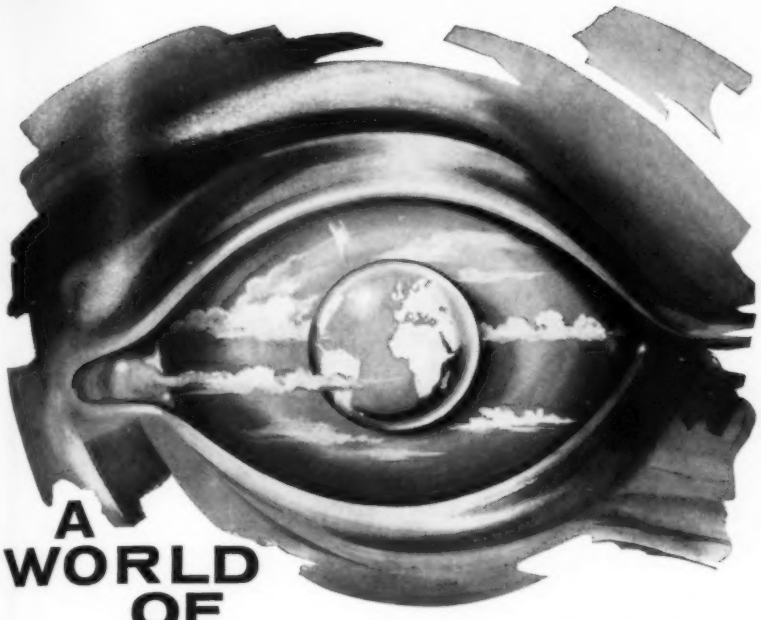

A WORLD OF VIBRATION

Vibration technology is a comparatively new development in the field of environmental engineering. Its applications in measuring metallurgical stresses and strains, in simulating fatigue to destruction point, are fairly well-known, but even the present scope is far wider than these. The potential is immense to a degree which possibly outreaches that of any other applied science. It is even possible that there is much to be rediscovered, for the histories and mythologies of ancient civilizations abound in references to physical motion achieved through sound vibrations. The destruction of the walls of Jericho is an example; and it has been suggested that the Pyramids' vast masonry was elevated by similar means. But fascinating and perhaps revealing as that line of inquiry may be, this report will deal principally with the immediately practical uses of vibration testing.

From eyes to motor cars is an apt and related part of the applications range. Taking the first and uncomfortably picturesque example, an incidence of severe headaches and impaired vision suffered by transport drivers led to tests with vibration equipment. These showed that through vibration on certain road surfaces, the drivers' eyes were being literally bounced back and forth in their sockets.

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Chemical and bio-chemical research are served by our smallest generator, the V47, in mixing, emulsifying and the measurement of interface potentials. It has been used also to simulate nerve signals and to assess vibration effect on living tissue. Experiments show that physical vibration and 'white noise' have anaesthetic properties.

Vibration equipment is used in the rubber, plastic and textile industries, as an aid in establishing the materials' mechanical properties.

Experiments in the machine tool industry have shown that small and carefully controlled vibrations can, in fact, improve stock removal, surface finish and minimize the effect of certain operations upon molecular structure.

This is inherently a world of movement. Everything vibrates within itself and often as an entity. These forces can be observed, reproduced, supplemented. There must therefore be many functions for our vibration equipment which even we can only guess at . . . and even more as yet unthought of. Name your problem; consider what may be done better, faster, more economically . . . what may be done perhaps for the first time, with the help of vibration equipment. It's more than likely that the means to the end is ready-made.

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8/600 Mk.II	300 lb
VG108 Mk.II	5,300 lb
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1 June 1961

PHANTOM II: The fighter with a dual role in Defence planning—Air Defence and Air-to-Ground Attack

The Phantom II, teaming two men with two engines to perform two missions at more than double-sonic speed, is the one airplane in production that combines unmatched performance with both all-weather air defence and long-range air-to-ground strike capability.

The two man crew concept of the McDonnell Phantom II makes full use of human reliability and judgment. Crew skills are substituted for electronic complexity and integrated with advanced radar, fire control, instrumentation and communication systems for total efficiency in mission performance.

Twin engines with afterburners combine safety and record-breaking performance. The Phantom II has reached an altitude of 98,560 feet, holds world closed-course speed records for both 100 and 500 kilometers and has a dash speed in excess of 1500 mph.

Sparrow III missiles and a host of other air-to-air and air-to-ground weapons, both conventional and nuclear, can be carried for complete versatility. Simply adding armament fits the Phantom II to the combat situation in minutes, in all kinds of weather, day or night.

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